The JOURNAL OF THE DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA

VOL. 8 (Third Series) MARCH – APRIL, 1959 No. 2

Published every second month by the Department of Agriculture, St. George's Terrace, Perth

The subscription rate (which includes postage) is 10s. per annum. Single copies 2s. each.

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J. A. MALLETT

Articles which appear in the "Journal" may be reprinted, provided that the "Journal" and the authors are acknowledged.

Issued by direction of THE MINISTER FOR AGRICULTURE.

COVER PICTURE

A typical orchard scene during early May showing the harvesting of Yates apples. Autumn colours are commencing to appear on the foliage of the trees and the natural weed cover crop has germinated forming a green carpet.

The Yates apple is one of the principal coloured varieties grown in the State. It is popular on export markets, particularly in the United Kingdom, and is the main red variety on the local market late in the season after an initial period in cold storage.

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22436/3/59—16,600

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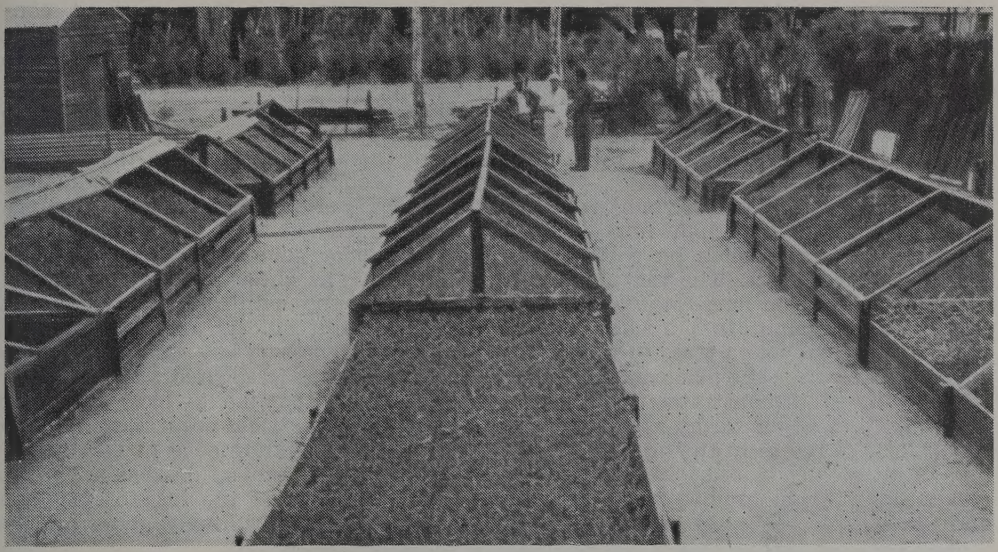

Fig. 1.—Frames containing Eucalyptus seedlings at the Dryandra Nursery

TREE ESTABLISHMENT IN THE WHEATBELT

By G. E. BROCKWAY, B.Sc. (Adel.), Regional Superintendent, Forests Department

DURING the last half-century, remarkable changes have taken place in the semi-arid lands of the southern portion of Western Australia. Millions of acres of country, once covered by an intricate pattern of hardy woodland, scrub and heath have been converted to productive arable land or pasture. With the widespread clearing and cultivation of vast areas, the correction of soil deficiencies by the application of fertilisers, and the sowing of cereals and annual pasture plants, many of the differences in soil types which were very obvious in the original landscape have now been obscured—adding greatly to the difficulties of successful tree establishment.

In the virgin state, the various soil types in this area could be easily recognised, as each supported its own vegetative association—the particular trees, shrubs and other plants adapted to the conditions which it provided.

Land was commonly classified by the type of vegetation it supported. That carrying large trees was "first-class," mallee and scrub country was "second-class" and the heath or sandplain was "third-class." The species of vegetation, their size and vigour and the degree of admixture, offered further indications of differences within the three main classifications.

It is not generally realised that by clearing the country "on a face" much natural evidence is destroyed and subsequent tree-planting must depend largely on trial and error.

This lesson should be taken to heart by every settler opening up new lands. Even today large areas of land are being completely cleared and trees which could be conveniently retained to provide fuel, timber, tan bark, shade, shelter and farm beautification are destroyed.

That it is essential to remove the greater part of this native vegetation is obvious, but unfortunately there is a marked tendency to lose sight of the desirable features which trees and scrub offer.

Isolated open fields surrounded by bush are soon replaced by open fields surrounded by more fields. Aesthetically the result is depressing, and with shade and shelter reduced well below the desirable minimum it will not be long before many farmers are seeking trees for farm and home planting.

Each season thousands of young trees go out from Forests Department nurseries for planting on farms which have been left with insufficient trees. The very fact that so many farmers on long-established properties are prepared to purchase, plant, protect and tend young trees so that they will ultimately take the place of those that were destroyed, demonstrates their recognition that trees on farms are desirable. The failure to retain in the original clearing, strategically-placed, healthy trees either singly or in groups or strips, was and is unwise.

The removal of a tree takes a few minutes—its effective replacement takes years and there are many pitfalls associated with its establishment.

THE ANNUAL DROUGHT

It must be realised that the annual domestic crops receive favoured treatment to free them from competition and to encourage their development. They are drought-escapers in that they complete their life-cycle during the wetter portion of the year, and, unlike the trees, they are not called upon to withstand the rigorous testing period of the annual drought.

The wheatbelt climate, which includes an annual summer drought of at least six months, necessitates the use of hardy trees able to withstand such conditions.

While a number of exotics are able to survive under these conditions, their growth is slow and none has yet been found that can surpass, or even equal, our native inland Eucalypts for rapid initial growth and long life. A wide range of these is therefore raised annually by the Forests Department and sold at cost throughout our farming areas.

OTHER PROBLEMS

The lack of data often available on the original vegetation of an area; the necessity to conform in a planting layout to farm subdivisions (in most cases laid out on a geometrical pattern without consideration of natural features or soil types), and the desire in many instances to establish trees on farms established on naturally treeless areas, have presented a range of problems.

With the object of learning the answers to the problems of farm tree establishment, the Forests Department some ten years ago commenced the establishment of arboreta or pilot areas throughout the wheat belt. As these regions are beyond the areas of the main forest activities, and visits by forest officers are infrequent, it has been necessary to obtain the co-operation of public-spirited farmers, other Government Departments, local governing bodies and other local organisations. Any advances in our knowledge of tree establishment in our semi-arid areas are in no small measure due to this co-operation and assistance so willingly given and so gratefully appreciated.

FACTS LEARNT FROM RECENT INVESTIGATIONS

Trees for the arboreta and for distribution to farmers became available with the establishment of the Kalgoorlie nursery where activities were confined to the propagation of species considered to be suitable for our inland areas.

This nursery has now been transferred to Dryandra in the Narrogin district where it continues to function satisfactorily and with a continually increasing output.

Many thousands of trees have been planted throughout the wheatbelt by farmers, local governing bodies, schools and in the arboreta or pilot areas already referred to. In some instances, establishment has been very successful, in others only moderately so and in others, partial or complete failure has resulted. The time has come to make some assessment of the causes of these various results.

Planting has been carried out on a wide range of sites and the position may be broadly summed up as follows:—

Tree establishment on areas which originally carried forest presents no serious difficulties provided there has been no salting of the area as a result of the rising water-table following clearing.

In view of the enormous areas of light land now being farmed, the need to pro-

Fig. 2.—(Left) A young tree removed from the pot showing the "gachi" or cone of soil with the roots coiled. (Right) The root coils straightened before planting

vide trees able to thrive on the country where nature grew none is a pressing one. While there are difficulties associated with tree establishment on such sites, the task is by no means impossible, except possibly on the poorest of sites, provided due attention is paid to scrub destruction, species selection, spacing distance and subsequent cultivation and protection.

When the writer in 1954, shortly before proceeding on an overseas assignment, examined several arboreta established from 1949 onwards on what are originally non-forest areas, some disturbing features were seen to be developing. After his return in 1957 these had become much more apparent and investigations were put in progress.

While these are by no means complete, the present article aims to give some indication of our present thoughts on the subject.

SPACING IS IMPORTANT

An examination of some of our inland heath land or even jam country at the end of a long dry summer shows much of the vegetation to be in an apparently dying condition and exhibiting a range of striking autumn colours. With the return of the wet weather, most of this vegetation revives. Beside this ability to go into a summer resting stage, these heath and scrub plants possess a number of other desert characteristics—e.g., small leaves, low quantity of aerial vegetative material, large root systems. For trees to become established in such sites they require all the assistance in the way of cultivation and freedom from weed and scrub competition that can be given—and ample areas from which to draw moisture.

Since sweet underground water is of extremely limited occurrence throughout the wheatbelt, the vegetation must subsist through this summer drought period solely on water stored in the soil at the end of the winter. The nature and depth of the soil and the nature of the subsoil are therefore factors of extreme importance.

At the outset, trees were planted at a spacing of approximately 15 ft. each way. For four or five years, growth of several species was extremely rapid even on the definitely non-forest sites. In the 1954-55 summer, however, a number of the most

Fig. 3.—Result of planting a young tree without straightening the root coils. The tree has been blown down as the coiled roots did not provide sufficient anchorage to withstand heavy wind pressure

vigorous of the trees on non-forest land declined rapidly in health and died in groups, and this process has continued since. The impression gained from these deaths was that the soil moisture from the annual precipitation (with possibly some residual moisture from the previous season) was ample to carry the trees on for a limited period of four or five years, but as crown area of the trees increased transpiration overtook the available moisture supply, and deaths occurred. Support was given to this view by the persistence in a healthy condition of the edge trees of the plots which have unchallenged access to surrounding cultivated land while trees within the central portion of the plots failed.

Field examinations appeared to support the moisture exhaustion view particularly when roots of some of the edge trees were found 100 ft. away from the plot.

Fig. 4.—A shelterbelt of sugar gums on the property of Mr. G. F. Dennis, Cunderdin

Fig. 5.—*Eucalyptus Dundasi* used to beautify the homestead site

A series of laboratory soil moisture determinations were commenced late in the 1957-58 summer and these will continue.

Several points have emerged from the studies to date, viz.

(1) A spacing 15 ft. x 15 ft. is too close for trees planted under semi-arid conditions. A figure in feet of $\frac{300}{R}$ where R = rainfall (in inches) of the locality is suggested as a minimum spacing distance.

(2) Block planting, or multiple line planting is inadvisable under low rainfall conditions.

(3) One or two rows of trees with cultivation on each side to eliminate scrub competition is the most desirable arrangement. This indicates that the multiple row break with tall trees in the centre shading off to dwarfs in the outer rows, while theoretically desirable, is not feasible in our semi-arid land. A double row arrangement —one of tall trees and one of short or medium, appears to be as much as can be expected.

(4) While inland Eucalypts have received considerable recognition as desirable trees for planting in the wheatbelt areas, for the more difficult sites, species with even better adaptations for drought resistance, e.g., *Callitris* (Native Pine) and *Casuarina* (Sheoak) warrant further attention.

HANDLING PLANTING STOCK

Types of containers used for raising nursery stock vary from country to country and state to state.

Trees in Western Australia are raised in 3 in. or 3¼ in. flower pots, or in trays which hold about two dozen plants. For a number of weeks prior to despatch from the nursery, they are given full exposure to ensure that they are sufficiently hardened off to stand conditions in the open field. Prior to despatch they are given a heavy watering, removed from the pots, each "gachi" (or cone of soil) is wrapped separately and the whole lot are packed tightly together in the crate in which they are despatched. In this condition, the soil remains moist for several days. When the purchaser takes delivery of them from the railway siding his first consideration should be to ensure that the trees are kept moist until they are planted. This is important! At time of despatch, plants are from 10 in. to 20 in. high. Any one wanting larger trees is advised to purchase the small ones and hold them for a year in large containers such as kerosene tins. It is not wise to use older larger plants raised in small containers as unless they are watered after planting or encounter very favourable moisture conditions, they are unlikely to survive on the water held in the limited amount of soil in contact with their roots. Even if they do survive, the pot-bound condition of their roots will lead to unstable trees liable to blow over before they are many years old.

Fig. 6.—Salt River gums *(Eucalyptus Sargentii)* growing on Mr. D. Dunwell's property at Narembeen

PLANTING ON FARMS

In farm planting, much of the attention normally recommended for the establishment of trees and shrubs cannot be given. For example, frequent or even occasional waterings are usually out of the question. Under such conditions this early period is critical and to ensure that young trees are given the greatest assistance to become established, the following planting methods are recommended—

Planting should be carried out only on land which has been well cultivated in advance. If on land which has not been previously cropped, at least two ploughings with a year or so interval between them is advisable to ensure that the native scrub is disposed of. **Digging of large holes and filling with enriched soil is inadvisable with trees which will be called upon to survive on the natural rainfall, although such treatment can be beneficial if trees are to be watered.**

Each plant should be unwrapped as it is required and if there is a coil of roots at the base of the "gachi" it should be straightened out and planted in a hole deep enough to take the straightened-out roots. Under favourable conditions it has been found possible to remove this coil of roots altogether but further investigations are needed to assess the risk associated with such treatment. The "gachi" should be buried about an inch below the ground surface. The soil must be firmed around the roots—good use being made of the fingers to ensure that no air pockets are left. A final gentle pressure with the foot should be applied to the soil surrounding the "gachi" and then a gallon or so of water given to settle the tree in its new home. A small quantity of superphosphate may be worked into the soil around the tree but do not overdo it or place the fertiliser in contact with the roots. One to two ounces per tree is plenty.

Protection from damage by humans, stock, vehicles or fire is essential.

KEEP THE GROUND WEED-FREE

Just as it is necessary to ensure that weeds are eliminated prior to planting so is it essential to ensure that they do not become re-established afterwards. There is no more potent cause of failure among young trees in the wheatbelt than grass and scrub competition during the first couple of seasons.

Weeds must be kept in check and surface cultivation between the trees in the late winter before the grass commences to dry is necessary for at least two years.

Several species can be satisfactorily raised in wooden or metal trays—about two dozen plants per tray. These are cheaper and some purchasers prefer them.

Fig. 7.—Gimlet *(Eucalyptus salubris)* makes an attractive street tree at Kalgoorlie

To remove trees for planting it is advisable to remove the side of the tray and take out each tree in turn in its own block of soil—a knife or edge of a trowel can be used to cut these out. Soil in the tray should be kept damp. Trees should be watered for a few days until they have recovered from the root pruning.

The most suitable planting season is in the early winter as soon as the ground is well soaked. This gives the young trees ample time in which to become established before they are called upon to withstand the summer drought.

It is advisable however, when contemplating planting to place orders for planting stock a couple of months in advance to ensure the reservation of your season's requirements.

HOLDING TREES IN LARGE CONTAINERS

Where only a limited number are planted each year, some farmers prefer to use larger trees. The seedlings as received from the nursery are held for about 12 months in large containers such as kerosene tins, old sanitary pans, etc. This system is also followed by a number of local governing bodies who find the larger trees less liable to theft or damage by vandals. Treated in this manner they require constant attention during the period they are held and considerably more trouble is involved in the actual planting operation.

The precautions which must be taken are—

(1) Containers must have provision for drainage through holes at the bottom of the sides.

(2) They should be supported an inch or two off the ground on blocks or bricks to discourage roots from penetrating the soil below. If roots do get down into the underlying soil and are allowed to persist there for any considerable time, their severance can cause the trees a considerable setback and possibly death.

(3) They should be given ample space to enable them to develop sturdily without competition from neighbours.

(4) Trees should be watered periodically as required. The frequency depends on the weather and may vary from daily in very hot weather to about twice per week in cool weather.

(5) Pruning should be avoided except to correct misshapen growth or double leaders.

Planting is much the same as for smaller trees except that considerable care must be taken to remove the container from

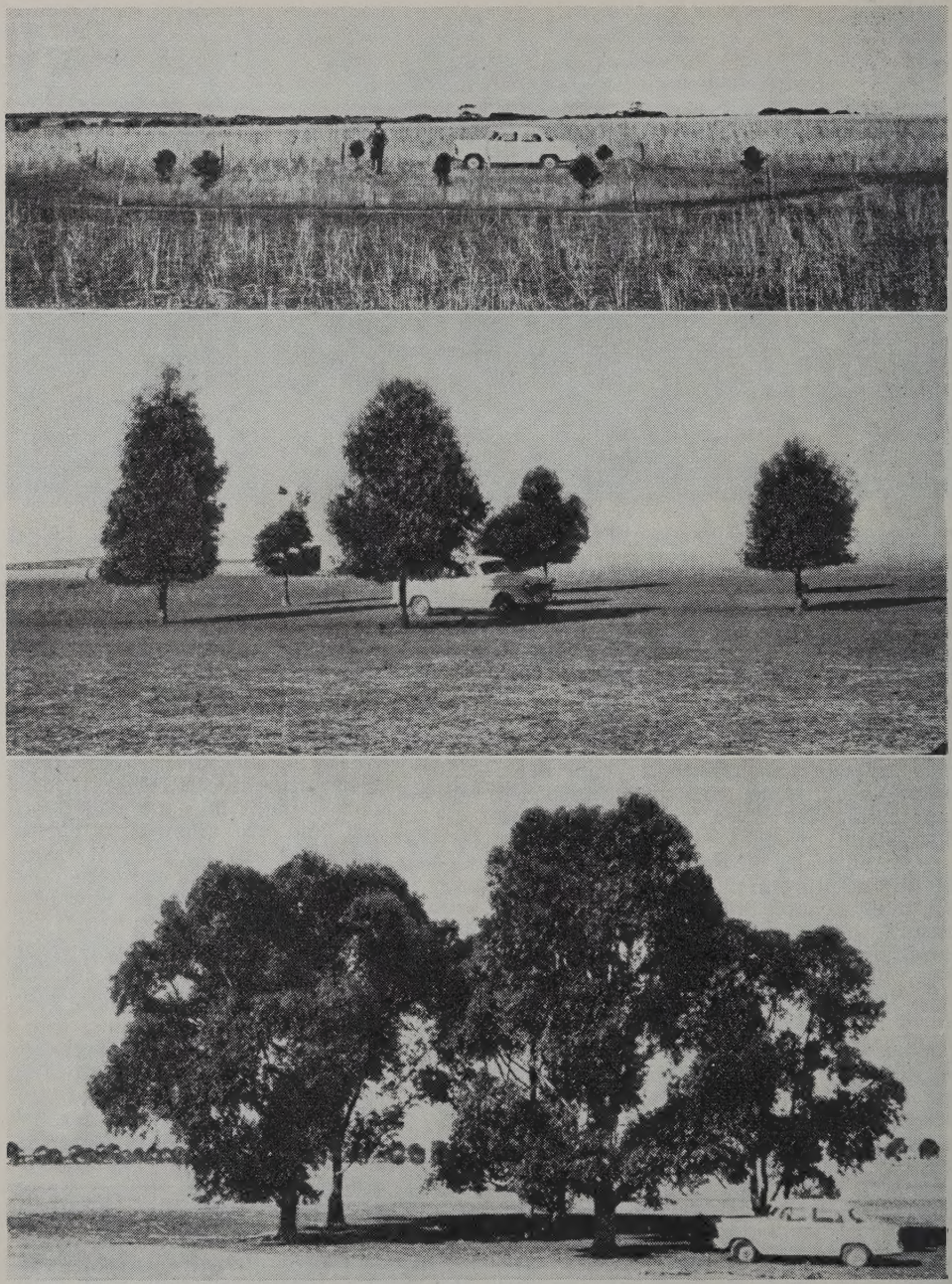

Fig. 8.—Sugar gums on the property of Mr. G. F. Dennis at Cunderdin. Top photo at one year old; Centre—four years; Bottom—11 years

the tree roots without causing damage to them or the block of soil in which they are growing.

PURPOSES OF PLANTING

Trees on farms may be planted for a variety of purposes, e.g., as windbreaks near buildings, as shelterbelts along contours or fence lines, as shade and shelter groups in paddocks, as ornamental and garden specimens and for the production of tan bark, fuel or farm timber.

The terms shelterbelt and windbreak are often regarded as synonymous but some authorities use the term "shelterbelt" to describe lines of trees protecting fields and "windbreak" for lines protecting buildings.

Shelterbelts.

A number of countries have, for a long time, accepted shelterbelts as a necessary feature of an agricultural countryside without always appreciating their shelter value.

While research into the effects of shelterbelts initiated in the early 19th Century, demonstrated the advantages, particularly on plain country, work was sporadic and is was not until the last 40 years or so that the question has been the subject of organised research in a number of countries—and shelterbelt planting continues.

> A survey of the available literature reveals that the majority of countries where research on shelterbelts has been undertaken have been concerned with the reclamation or improvement of agricultural plain areas and not with uplands regions.
>
> (From "Shelterbelts & Micro Climate"—J. M. Caborn).

The comparatively flat terrain of our wheatbelt renders it amenable to such improvement.

Wind velocity near the ground is reduced by the frictional drag of the land surface and by obstructions such as tree belts, etc. A reduction in the velocity of wind means a reduction in its erosive and drying effects.

To be effective a shelterbelt need not be extremely dense; it is in fact preferable for it to be to some extent penetrable by the wind as this prevents the formation of a low-pressure zone in its immediate lee, which may give rise to turbulence there. In other words, rather than aiming at an obstruction to be by-passed by the wind what is needed is a moderately penetrable barrier which will exert some frictional braking effect on the wind.

Most research results indicate that while the noticeable advantages of shelterbelts occur on the leeside for a distance of 10 to 20 times its height—the beneficial effects although to a less marked degree, may be recorded over twice that distance, including a cushion zone on the windward side of the belt.

On the cumulative effect, I quote the following:

> It would seem that if two parallel belts are separated by a distance equal to 26 times the height of the more windward belt, the entire intervening area will be sheltered to some extent and the un-obstructed wind velocity will not occur between the belts. (1) ("Shelterbelts & Micro Climate"—J. M. Caborn).

Under conditions of low rainfall a dense belt cannot be maintained.

Strips of trees or even low vegetation left along roads in localities where drift from cultivated land is considerable, can protect the roads from the accumulation of wind-blown material.

Possibly the greatest drawback associated with establishment of long shelterbelts is the cost of providing the fencing necessary to protect them, during the establishment stages, from domestic stock and rabbits.

With the reduction of rabbit population as a result of modern methods of vermin destruction and the development of stock movement by motor transport rather than on the hoof, planting along roadside strips outside the fences has possibilities. A test strip cultivated to a width of 25 or 30 ft. adjoining the fence with a row of trees planted down the middle, has been established by the Department of Agriculture at the Newdegate Demonstration Farm and is being watched with interest. A similar belt at the Eneabba Settlement was established in 1958.

It is considered more desirable by advocates of "keyline" development to estab-

Fig. 9.—The athel tree (*Tamarix Aphylla*) is a useful and attractive tree easily propagated from cuttings

lish trees approximately on contours, and by people of an artistic disposition to grow them in anything but straight lines, and while their views can be appreciated it is usually necessary to take into account existing farm subdivisions and make shelterbelts fit into their pattern.

Windbreaks.

Where no provision has been made to retain natural vegetation around a homestead site, the establishment of a protective windbreak is highly desirable both for its aesthetic effect and for the shelter and comfort it provides. Bushy trees of medium height with attractive foliage and blossoms are desirable. Trees should not be planted within 30 ft. of any building.

As ornamental specimens for gardens far too little use is made of our smaller Eucalypts, some of which such as *Eucalyptus caesia* and *Eucalyptus erythro-*

Fig. 10.—Nine-year-old Salt River gums growing on salty land at Yuna

nema to name only two, have large, brightly-coloured, attractive blossoms.

Shelter or Shade Groups.

These may be established near watering places or dotted about the paddock. It is better that these groups should be small—consisting of about seven or nine trees—preferably large-crowned species.

If seven trees are used they should be planted with six trees in the form of a hexagon and the seventh in the centre. If nine are used they should be in three parallel rows of three so that they form a square with one tree in the middle. Spacing between trees should be not less than 30 ft.

Fig. 11.—*Casuarina huegeliana*, a member of the she-oak family, growing at Dryandra

In each of these arrangements every tree but one is an outside tree able to draw on the surrounding land for its subsistence.

Protection is necessary for four or five years and possibly longer with the slower-growing species. This can be provided by a temporary fence supported by pointed stakes driven into the ground. Once the trees are nine or ten feet high it is safe to remove the fencing for use elsewhere, provided sheep only are allowed access.

PLANTING OR SOWING ON NON-AGRICULTURAL LAND

It is sometimes suggested that land unsuited for agriculture should be devoted to the growing of trees, but one needs to be very cautious when approaching any tree establishment project on this basis.

Trees respond to good soil and moisture conditions as do any other plants and if they do manage to survive on poorly prepared infertile sites, development is often unsatisfactory. There are however, exceptions as in the case of the stony mallet hills in the region of the Great Southern Railway (and east of it) or the "breakways" throughout the eastern wheatbelt, which normally carry wandoo patches.

These areas of high ground, if cleared, absorb rain slowly, acting like the roof of a house with the resultant run-off scouring the adjoining fields. Contouring first to stop this erosive run-off and give the rain a chance to soak in, and then planting or sowing with appropriate species, e.g., white, blue or brown mallet or wandoo or powder bark is a rational sequence.

Direct sowing with mallet seed can be successful, but usually only when sowing is carried out on ash-beds on land recently subjected to fierce fire. However, in the mallet areas of the southern wheatbelt when farmers are able to collect ample quantities of seed themselves, direct sowing is worth considering.

To re-establish trees on these mallet hills where they have been inadvisably cleared, the first step after contouring should therefore be to make a number of small heaps of branch wood, etc., sufficient to give a hot fire or fair duration. Just burning a heap of leaves is not enough.

Spots about a foot in diameter are then lightly cultivated in these burnt patches. A pinch of seed is dropped on the cultivated spot and after covering it with a light layer of soil the spot should be firmed with light pressure of the foot. Sowing should be done in late summer prior to the first rains.

Fig. 12.—*Eucalyptus cladocalyx* growing in deep yellow sand between the 180 and 181 mile pegs on the Geraldton Road

TREE PLANTING IN COUNTRY TOWNS

Tree planting in country towns in streets, parks, recreation areas and school grounds is increasing in popularity and reflects a growing civic pride and a greater sense of stability.

For several generations the sugar gum was the best answer to the road board secretary's prayer, despite the fact that once the trees became established it was often necessary for him to annually devote road board funds to lopping limbs away from overhead wires. Some of the more bushy Eucalypts, e.g., silver gimlet and coral-flowered gum do the job just as well or better, and at considerably less recurring expense. I have it on the good authority of a nurseryman friend in California that one of the most valued street

Fig. 13.—Road line planting on the Newdegate Demonstration Farm

trees in his region is the "Moort" of our South Eastern wheatbelt. Moort has hardly been thought of in Western Australia, except as something which grows in tangled thickets which have to be cleared to make room for wheat and sheep.

The shorter, more bushy, trees similarly have something to commend them for planting in school grounds and parks. Limbs occasionally fall from trees and while the chance of anyone being injured is somewhat remote, it is inadvisable to run the risk in places where people tend to congregate in large numbers. Dangerous limbs can be much more easily removed from small trees and if they do split or break off they are likely to do less damage than if they fall from a great height.

Due to the possible lack of moisture in the soil as a result of unnatural surface conditions, such as sealed roads within a town area, periodic watering of trees for the first one or two summers is advisable, even if large two-year-old trees are used.

CHOICE OF SPECIES

Although approximately 50 species or varieties of Eucalypts are raised each year, the main demand is for a very limited proportion of these. Thus the three most popular represent 44 per cent. and the ten most popular 72 per cent. of the distributions.

In 1958, the actual numbers distributed from the Dryandra nursery of the ten species most in demand were as follows:—

(1) River Gum *(Euc. camaldulensis)*	6,900
(2) Sugar Gum *(Euc. cladocalyx)* (1,550) *(Euc. cladocalyx* var. *nana)* (1,080)	2,630
(3) Dundas Blackbutt *(Euc. dundasi)*	2,620
(4) Coral Flowered Gum *(Euc. torquata)*	2,500
(5) Wandoo *(Euc. redunca)* (500) *(Euc. redunca)* (inland) (960)	1,460
(6) Brown Mallet *(Euc. astringens)*	1,400
(7) Dundas Mahogany *(Euc. Brockwayi)*	840
(8) Yellow Flowered Blackbutt *(Euc. Stricklandii)*	800
(9) Flat Topped Yate *(Euc. occidentalis)*	650
(10) Salt River Gum *(Euc. Sargentii)*	570

It might be noted that salmon gum and gimlet which were at one time extremely popular, now occupy eleventh and sixteenth places, with 550 and 300 trees respectively.

The popularity of Nos. 1, 2, 4 and 5 can be attributed to their ability to adapt themselves to a wide soil range including some of the lighter sandplain soils.

For the heavier soils, Nos. 3, 7 and 8 are outstanding, while No. 10, which is the most salt-tolerant species available would have occupied a much higher position in the list had more stocks been available.

Nos. 6 and 9 are trees of a somewhat higher rainfall zone and I would be diffident about recommending their use for the lower rainfall portion of the wheatbelt.

While the relative demands for the various species give some indication of their suitability for wheatbelt planting the choice is often based on rather limited data. Thus if a species is introduced to a district and thrives, the demand for it may increase rapidly, the species selling itself. On the other hand, an equally good, but lesser-known tree may be passed by.

Furthermore, trees which show early promise do not always maintain it as they get old and while the above list, on our present knowledge, appears a good one, it is not unlikely that some other species now little planted, may spring into prominence.

Where farmers have individual problems relating to tree establishment they are invited to communicate with the Forests Department, Perth, or with the District Forester, Dryandra, via Narrogin.

The attached table lists the species normally raised and indicates their possible suitability for the various sites and purposes.

TREE PLANTING GUIDE

THE trees listed below may be obtained by writing to the Forester-in-Charge, Dryandra Nurseries, via Narrogin, and enclosing remittance to cover cost and freight to the purchaser's siding. All trees are priced at 2s. 3d. each or 24s. per dozen, free on rails, Narrogin.

Species and Common Name	Locality and Soil Type	Rainfall of Natural Habitat	Description	Purpose for which Recommended	Remarks
MALLEE .. .. (*Euc. angulosa*)	Esperance to Comet Vale. Sandy soil	8 in. to 25 in.	A rather straggly mallee .... Height : to 20 ft.	Fixing heavy sand	Seed from the northern portion of the range recommended for planting in sand dunes in arid area. The Esperance mallee suitable for dune planting nearer the coast.
POWDER BARK .... (*Euc. accedens*)	Covers a wide range on the east of the jarrah belt, extending east and north to about the 17th isohyet	17 in. to 30 in.	A rather vigorous shade tree for elevated sites. Leaves glaucous, giving tree a dull bluish appearance Height : 80 ft.	Shade and shelter in the western and north-western wheatbelt	A possibly useful tree for the medium rainfall areas in the region of the Great Southern Railway. Useful for elevated laterite sites.
BROWN MALLET .... (*Euc. astringens*)	Extends both east and west of the Great Southern Railway from Broomehill to Beverley. Occurs in elevated laterite gravels overlying friable clay	15 in. to 20 in.	An upright tree with bronze-coloured bark and dark leaves. A distinct umbrella crown Height : to 70 ft.	Shade and shelter. Tan bark production. Produces a tough timber suitable for tool handles	A useful tree for the western wheatbelt, not recommended for areas with less than 15 in. rainfall. Will thrive on loam, gravel or sand provided drainage is good and there is a fair depth of soil over a clay sub-soil.
DUNDAS MAHOGANY .... (*Euc. Brockwayi*)	Elevated diorite country near Norseman. Medium loams	11 in.	An upright tree of vigorous growth. Bark pinkish-grey and leaves dark green, shining Height : to 80 ft.	Shade and ornamental tree. Produces a tough timber suitable for tool handles	This tree is similar to Salmon gum in appearance but when young it is of more attractive shape. Should be planted on good loams.
GUNGUNNU .... (*Euc. caesia*)	On sandy soils on and near granite rocks in eastern wheatbelt	12 in.	Bark is thin and varies from dark greenish-brown to bronze. Leaves are dull but flowers are large and an attractive pink shade Height : 25 ft.	Ornamental purposes around homesteads	This tree can be grown on a wide range of soil types. It needs some pruning to keep it compact and shapely.
SUGAR GUM .... (*Euc. cladocalyx*)	A South Australian tree. From Flinder's Range, Kangaroo Is., etc.	18 in. to 28 in.	A fast-growing tree with smooth bark and vigorous crown Height : 70 ft.	Street planting, shade groups, shelter belts, etc.	This is not recommended for heavy soils or shallow soils but usually does well on light or medium loams and in deep sands. Leaves are sometimes eaten by stock and vermin. Should not be planted in localities with less than 15 in. rainfall.
DWARF SUGAR GUM .. (*Euc. cladocalyx* var. *Nana*)	A South Australian tree. From Flinder's Range, Kangaroo Is., etc.	..	A fast-growing tree with smooth bark and vigorous crown Height : 30 ft.	Street planting, shade groups, shelter belts, etc.	A more compact dwarf form of *Euc. cladocalyx*.
RIVER GUM .... (*Euc. camaldulensis*)	Occurs along river courses in the drier portions of Australia and usually on loams and sands	8 in. to 28 in.	Bark is white or grey and smooth, leaves are dull—smaller branches may be either pendulous or erect Height : 90 ft.	Ornamental shade and shelter. Windbreaks or shelter belts. (A very good general purpose tree)	A most adaptable species and by far the most popular tree distributed. Thrives on a wide range of soils. Not recommended for shallow gravels.

SILVER GIMLET (*Euc. campaspe*)	Eastern Goldfields. Loamy sand to medium loam	7 in. to 9 in.	A drought-resistant, wide-spreading shade tree of low height growth. A good tree for planting under electric light lines. Bark is smooth and bronze-coloured. Leaves are bluish in colour and bark on smaller twigs is almost white Height : 30 ft.	Shade, windbreak and ornament	For the better loam soils of the eastern and northern wheatbelt this tree could prove outstanding.
COOLGARDIE BLACKBUTT (*Euc. Clelandi*)	Hilly country near Coolgardie	9 in.	Drought-resistant tree. Leaves glaucous. Lower bark black and rough. Bark on upper trunk and branches light grey and smooth Height : 30 ft.	Shade tree	Has not proved at all outstanding for wheatbelt planting. In its natural habitat it makes a well-crowned tree but it requires well-drained loam soils.
DUNDAS BLACKBUTT .... (*Euc. Dundasi*)	Norseman District on light to medium loam	10 in.	A drought-resistant, attractive tree with dark shining leaves. Upper bark smooth and bronze-coloured, lower bark black and rough Height : 50 ft.	Good all-purpose tree for the better quality loam soils	This tree has proved extremely popular and is very suitable for most purposes but should be planted only on good soils.
MALLEE .... (*Euc. Drummondii*)	Great Southern and Northam	18 in.	A tall mallee with small oval-shaped rather dull leaves Height : 25 ft.	For planting on poor deep sandy gravel where other species are likely to fail	This tree is not outstanding and is not recommended for the central or eastern wheatbelt. It may be useful on sites where other species fail.
MALLEE .... (*Euc. Ebbanoensis*)	In northern wheatbelt and at Comet Vale in red sand (loamy). (Comet Vale strain is used for propagation)	8 in.	A very drought-resistant wide-crowned shady mallee. Bark is grey to bronze-coloured Height : 25 ft.	For low shade	This has proved hardy in arboreta but its growth over the first few years is slow. Appears able to survive on quite poor sites.
WHITE MALLEE .... (*Euc. erythronema*)	Throughout greater part of the wheatbelt, usually in medium to heavy loams	10 in. to 12 in.	A rather handsome erect mallee. Specimens with white, red or pink flowers Height : 20 ft.	Ornamental, garden specimen and street planting. Leaves have high Eucalyptus oil content	The pink or red blossomed specimens have proved popular. Recommended for the better loam soils only.
MERRIT .... (*Euc. Flocktoniae*)	Eastern wheatbelt - Goldfields, Norseman district in light to medium loams	7 in. to 12 in.	A drought-resistant erect tree with white bark and very dark leaves. Crown rather narrow which detracts from use as a shade tree Height : 35 ft.	For line planting. Along drives and street planting provided no overhead wires	This tree is being tried with some success on sandy loams which originally carried mallee and tammar scrub.
WHITE MALLET .... (*Euc. falcata*)	Southern and south-eastern wheatbelt and Ravensthorpe District. Grows on poor sands and gravels	13 in. to 18 in.	The mature tree has a spreading umbrella crown but does not normally give good shade. Young trees are rather spindly Height : 35 ft.	Will grow on rather poor soils and is worth trying on the poorer laterite and sandy sites in western wheatbelt	This tree is rather disappointing as a shade tree and is not recommended for central or eastern wheatbelt.
FUSCHIA MALLEE .... (*Euc. Forrestiana*)	Grass Patch in Esperance District	15 in.	An attractive mallee up to 20 ft. high. Capsules at flowering time are bright red in colour Height : 20 ft.	Ornamental and garden specimen	This species has been widely planted as an ornamental. It has little value for other purposes such as shade or shelter.
BLUE MALLET .... (*Euc. Gardneri*)	Southern and south-eastern wheatbelt. Laterite slopes with clay subsoil	12 in. to 17 in.	With adequate spacing it develops into an attractive specimen with large dense crown. Leaves blue-green in colour Height : to 35 ft.	Shade, windbreak, ornamental. Tan bark	This tree shows promise as a desirable tree for farm planting on a range of soils, particularly in the southern portion of the wheatbelt.

TREE PLANTING GUIDE—continued

Species and Common Name	Locality and Soil Type	Rainfall of Natural Habitat	Description	Purpose for which Recommended	Remarks
YORREL .... (*Euc. Gracilis*)	Yilgarn District. Light to medium loam near lakes	11 in.	If open grown it forms good shady crown. In forest formation umbrella crown. Butt bark dark and rough, upper trunk and limbs smooth and bronze-coloured Height : 40 ft.	Street planting shade and shelter belts	Fairly salt-tolerant and for suitable site should prove very useful.
STOCKING GUM .... (*Euc. Kondininensis*)	Kondinin southward. Medium to heavy loams. Salt-tolerant	12 in.	In open formation is a fine shade tree with umbrella crown Height : 45 ft.	As shade tree	This is an attractive tree under natural conditions but to date it has not proved a good nursery subject and early growth in the field has been poor.
BOOK LEAF MALLEE .... (*Euc. Kruseana*)	About 80 miles east and south-east of Kalgoorlie. On loamy sand near granite outcrops grows in association with jam bush	8 in.	A very drought-resistant tree of unique appearance. Flowers yellow and in spike-like arrangement. Leaves are small, round, sessile and bluish in colour Height : 20 ft.	Ornamental. Garden planting	The unique appearance of this tree and its ability to survive on shallow soil makes it a desirable species for arid granite country.
GOLDFIELDS BLACKBUTT (*Euc. Le Souefii*)	Eastern Goldfields. Sandy gravel to loam	9 in.	Bark of butt dark and rough. Limbs grey and smooth. Crown umbrella-shaped — generally somewhat open Height : 35 ft.	Shade tree for medium loam and gravelly loam soils	Generally has been rather disappointing except on the best sites.
MORRELL OR POOT .... (*Syn. Euc. oleosa* var. *longicornis*)	Over most of the wheatbelt. Medium loams often with calcium, carbonate and gypsum, in the subsoil	11 in. to 16 in.	Bark rough and stringy. In forest formation has a rather poor open crown but grown as an isolated tree it develops a good shady crown Height : 70 ft.	Shade and shelter belt	A useful tree for fluffy calcareous soils near lakes.
BALD ISLAND MARLOCK .... (*Euc. Lehmanni*)	South coast and some of islands of Recherche Archipelago. Sands	24 in.	When young has a round bushy crown and retains its globular form with limbs close to the ground for a number of years. As the tree ages it develops an umbrella crown Height : 30 ft.	Shade tree, windbreak, shelterbelt or as a large ornamental in or near gardens	This has proved one of the best trees for the Esperance Plains but is not recommended for drier portions of the wheatbelt.
YORK GUM .... (*Euc. Lozophleba*)	Widespread in western wheatbelt with isolated patches in central, eastern and northern wheatbelt. Loams often associated with granite	12 in. to 20 in.	A fair shade tree and with umbrella crown. Trunk, rough, barked and usually crooked Height : 40 ft.	Shade tree, for planting in granite country, also along water courses in the western wheatbelt	This tree is fairly salt-tolerant and for this reason is often retained along water-courses.
MOTTLECAH OR ROSE OF THE WEST (*Euc. macrocarpa*)	Central wheatbelt. Poor sands and sandy gravel	14 in.	A low mallee with large sessile grey leaves, which bear very large scattered red blossoms Height : 15 ft.	As an ornamental for garden use	One or two isolated specimens desirable. Not recommended for planting in large numbers.
YELLOW BOX .... (*Euc. Melliodora*)	Central New South Wales	15 in. to 25 in.	Bark is rough and leaves small and greyish-green in colour. When young has rounded crown. Old trees have rather sparse umbrella crown Height : to 80 ft.	As a honey-producer this is one of the leading trees in Australia. Would be a useful adjunct to local species for honey production. Fair shade tree	Recommended for the western and central wheatbelts for a wide range of soils, but prefers lighter soils.

RED WOOD OR RED MALLEE (*Euc. oleosa*)	Eastern Goldfields in red sands and sandy loams	7 in. to 10 in.	Bark rough and timber interlocked. Leaves dark and shining. It usually, but not invariably, has a mallee form. Trunk usually crooked Height : to 30 ft.	As a shade tree in very dry areas but growth is slow. Some varieties provide eucalyptus oil	The outstanding characteristic of this species is its drought resistance. For the higher rainfall areas there are better trees.
FLAT-TOPPED YATE .... (*Euc. occidentalis*)	Southern wheatbelt and eastwards to Esperance and Salmon Gums district. Occurs in low-lying poorly-drained country in clay soils with or without a sandy surface	16 in. to 20 in.	A tall tree with umbrella crown when mature. For the first few years it tends to form a very narrow crown but if grown as an isolated tree the crown starts to spread at seven or eight years of age. Bark on trunk is dark and rough but on limbs bark is grey and smooth Height : to 80 ft.	Shade tree	If planted in the drier portions of the wheatbelt it should be grown in deep light soil and given freedom from competition to ensure its having ample moisture to maintain it.
MOORT .... (*Euc. platypus*)	Southern wheatbelt and Ravensthorpe district in medium to heavy loams	15 in.	A low tree often occurring with poor form in dense thickets. Grown with ample room it develops into an attractive tree with a good dense rounded crown Height : 25 ft.	Shade, street planting. Low windbreaks or shelter belts	This tree has been too little used in this State and is worthy of much greater attention.
BELL-FRUITED MALLEE .... (*Euc. preissiana*)	Scattered from Stirling Range to Esperance district. On poor sandy gravels	16 in. to 20 in.	A mallee which produces attractive yellow blossoms Height : 8 ft. to 15 ft.	Ornamental—garden specimen	One or two specimens for garden use are often desirable. Should not be planted in large numbers.
Euc. pterocarpa (*Euc. corrugata* var. *pterocarpa*)	Norseman district in gravelly loam	10 in.	A rather attractive tree with white bark and fairly large leathery leaves. It produces attractive white blossoms and unique ribbed buds, and seed capsules Height : 30 ft.	Shade purposes	This is a little-known tree but the few specimens which have been established both here and at Broken Hill indicate that it has distinct possibilities for farm planting.
WANDOO OR WHITE GUM (*Euc. redunca* var. *elata*)	From the face of the Darling Range—inland to the Goldfields. Usually on clay soils although the inland form also occurs on lateritic sands	9 in. to 30 in.	This tree has greyish-coloured fairly smooth bark and grey-green leaves Height : to 90 ft.	Shade purposes. It produces useful timber and is a valuable nectar producer. The inland form is recommended for use on poor gravelly sands	Two distinct forms are propagated, viz., a western form suitable for the heavier rainfall area and an inland form suitable for a wide range of soil types in the wheatbelt.
SALMON GUM .... (*Euc. salmonophloia*)	Occurs over the greater part of the wheatbelt and eastwards, well beyond Kalgoorlie. Occurs in medium to heavy loams	7 in. to 17 in.	Bark smooth salmon-coloured. Fairly dense crown if grown as an isolated tree but rather light umbrella type when in natural forest. Leaves small and shining Height : to 80 ft.	Shade tree—avenue planting, windbreak or shelter belt (should not be planted in poor or light soils)	This is the best-known tree in inland W.A. Early development is rather slow but ultimately develops very satisfactorily.
COMMON GIMLET .... (*Euc. salubris*)	Occurs over the greater part of the wheatbelt and eastwards to the Goldfields and beyond. In medium to heavy loams	7 in. to 16 in.	Bark smooth, bronze-coloured. Trunk usually straight and fluted. Leaves dark green. Umbrella crown but if given adequate spacing forms good small shade tree Height : to 35 ft.	Shade tree and for street and avenue planting	This is a good vigorous species and is deserving of consideration for the heavy red loams of the wheatbelt.
SALT RIVER GUM .... (*Euc. Sargenti*)	Occurs in central wheatbelt from Cunderdin eastwards. Confined to low-lying sand and loam soils near salt lakes	15 in.	When mature the crown is small and umbrella-like. Young trees, given ample space and freedom from competition, have a bushy globular crown Height : 30 ft.	Shade and shelter or low windbreak in salty areas	This is one of the most vigorous of all species established in arboreta.

TREE PLANTING GUIDE—continued

Species and Common Name	Locality and Soil Type	Rainfall of Natural Habitat	Description	Purpose for which Recommended	Remarks
YELLOW-FLOWERED BLACKBUTT (*Euc. Stricklandii*)	Norseman, Kalgoorlie, Bulong, etc. Usually in hilly country on dark gravels and gravelly loams	7 in. to 11 in.	Bark for lower half of trunk is black and rough. Above that it is grey and smooth. Leaves large and shining. Blossoms large, yellow and attractive Height : 33 ft.	Shade, shelter and ornament. Very drought-resistant	This tree should be planted on loams or dark gravels. Not suitable for poor light soils.
SWAMP MALLET .... (*Euc. spathulata*)	Central and southern wheatbelt on medium to heavy loams, generally in low-lying sites	12 in. to 15 in.	A tree somewhat like gimlet in appearance. In some areas it attains a height of 35 ft., in other areas it is of only small size. Leaves are small and narrow	Shade, shelter and windbreaks in low-lying areas. The bark has a high tannin content but is too thin to be commercially valuable	This tree has proved popular for windbreak planting in Victoria.
PEAR GUM ... . (*Euc. Stoatei*)	Ravensthorpe district. Poor lateritic sand	16 in.	White-barked with dark green leaves. Buds and seed capsules are large, pendulous and just prior to, during, and immediately following flowering are a distinct red colour Height : to 25 ft.	Street planting and ornamental ...	This is rather a compact, slow-growing tree but has proved popular as an ornamental.
WING-FRUITED MALLEE . (*Euc. tetraptera*)	Ravensthorpe and Esperance district. In poor gravelly sand	14 in. to 24 in.	A small shrubby mallee seldom exceeding about 8 ft. in height. It has large leathery leaves and large unique buds and seed capsules	As a unique garden specimen ...	Apart from its value as a garden shrub it has little value for farm purposes.
CORAL-FLOWERED GUM .... (*Euc. torquata*)	Norseman to Coolgardie and eastwards on loamy gravel hills	7 in. to 10 in.	A low tree with rounded crown. Leaves dark green but lacking lustre. Handsome blossoms from white to deep pink Height : to 30 ft.	Shade, shelter, ornament or garden use. Useful for the more arid areas	Thrives best on the better loams of the wheatbelt but also worth growing on loamy gravels. A very popular species.
BOONGUL ... ... (*Euc. transcontinentalis*) (syn. *Euc. oleosa* var. *Glauca*)	Eastern wheatbelt to Goldfields and also as a mallee in South Australia. Medium to heavy loams	7 in. to 12 in.	A tree of very variable form and appearance. The Eastern Goldfields strain which is the one propagated has a clean white bark and glaucous leaves and is quite an attractive tree. Blossoms are fairly large and light yellow in colour. Height : to 40 ft.	Shade tree . . .	This is quite a good tree for shade purposes but is possibly less reliable and less attractive than some of the other species available.
LEMON-FLOWERED GUM ... (*Euc. Woodwardi*)	North of the Transcontinental Railway about 100 miles east of Kalgoorlie. Deep sandy loams	7 in.	A rather open-crowned tree which in its mature form bears pendulous branchlets. Leaves are large and glaucous. The large lemon-yellow blossoms are very attractive Height : 35 ft.	Ornamental	This tree has a tendency to develop a very open crown and to bloom rather too heavily at the expense of leaf development. When grown on good loam it may develop into a handsome tree but on poorer sites it is generally a failure.
(*Euc. Woodwardi*) (*Euc. torquata* hybrid)	A number of natural hybrids have been obtained from seed collected from selected trees of these two species planted close together in Kalgoorlie	8½ in.	These are taller than *Euc. torquata* and more dense crowned than *Euc. Woodwardi*. Blossoms yellow or brownish-yellow. Bark dark grey and smooth Mature height unknown, probably 40 ft.	For shade, shelter and ornament	A limited number of these trees are propagated each year. The hybrid appears to be a big improvement on *Euc. Woodwardi*.

WHITE CYPRESS PINE OR NATIVE PINE (*Callitris glauca*)	Inland New South Wales on sands and medium loams and in Western Australia on sands and loams near inland lakes	7 in. to 25 in.	The New South Wales form is a tall symmetrical tree which provides useful timber. The Western Australian form seldom exceeds 30 ft. and is used mainly as fence posts	For shade, windbreak or ornamental	The Callitris are much slower and less spectacular than most Eucalypts in their early years but appear able to survive under adverse drought conditions on poor sandy sites where Eucalypts fail.
(*Callitris propinqua*)	Inland New South Wales	18 in.	A symmetrical tree with more brightly coloured foliage than *C. glauca* Height : 40 ft.	For shade and ornamental	Grown in aboreta on poor sands this tree is developing very similarly to *C. glauca*.
BLACK PINE .. .. (*Callitris calcarata*)	Inland New South Wales	15 in.	A symmetrical tree with more brightly coloured foliage than *C. glauca* Height : 40 ft.	For shade and ornamental	Appears satisfactory on poor sites, including laterite gravels.
ROTTNEST CYPRESS .... (*Callitris robusta*)	Western coast of W.A. On sand with limestone	35 in.	A symmetrical tree with more brightly coloured foliage than *C. glauca* Height : 30 ft.	For shade and ornamental	Suggested for sandy sites in southern wheatbelt.
SWAMP SHEOAK .... (*Casuarina glauca*)	Swamp areas in Western wheatbelt and closer to the coast ; also in South Australia	12 in. to 35 in.	A dense-crowned sheoak—quite a good shade tree. Height : to 30 ft.	A shade tree for low lying salty areas	Should not be planted right in salt channels but close to the edges of them.
NORTHERN SHEOAK .... (*Casuarina Dielsiana*)	Northern wheatbelt on poor stony soils	12 in.	A drought-resistant sheoak—suitable for elevated rocky areas	Shade tree....	This is a recent introduction with possibilities for the heavier soils.
DESERT OAK .... (*Casuarina Decaisneana*)	Desert country near Canning Stock route, etc. On sandhills	6 in.	A drought-resistant sheoak .. . Height : to 30 ft.	Shade tree. (Stocks unavailable at present owing to shortage of seed supplies)	Difficulties have been encountered in establishing this species, but two in an arboretum at Morawa have grown vigorously.
ROCK OAK .... (*Casuarina Huegeliana*)	Throughout the wheatbelt on sands in the vicinity of granite rocks. Also in the eastern jarrah bush	12 in. to 30 in.	A symmetrical tree. Carries dense globular crown Height : to 30 ft.	As a shade tree on poor shallow sands	This tree will persist on shallow sandy soils around granite rocks areas where Eucalypts would perish. Warrants considerably more consideration than it now receives.
ARIZONA CYPRESS .... (*Cupressus arizonica*)	U.S.A.	.. .	A symmetrical cypress with greyish-green foliage Height : 50 ft.	Shade, windbreak, ornament	Quite a drought-resistant tree. Its main drawback is its slow rate of growth.
PEPPER TREE .... (*Schinus molle*)	Brazil	....	A well-known tree. Fine pinate leaves and pink berries. Crushed leaves have aromatic odour Height : 30 ft.	Shade or ornament	This tree seldom thrives unless well protected from heavy wind, etc. Should not be planted near septic systems or flower gardens.
ATHEL-TREE OR TAMARISK (*Tamarix articulata* (Syn. *T. aphylla*))	India, North Africa, etc.	6 in. upwards	A fine-leafed tree. Foliage greyish and dense. Flowers small and pink Height : 50 ft.	Shade, windbreak, ornament	Useful for the heavier soils. Salt-tolerant. Easily grown from cuttings.
JAM .... (*Acacia acuminata*)	Western wheatbelt	12 in. to 20 in.	A small tree with rounded umbrella crown Height : 25 ft.	Shade and for use as fence posts .	While jam posts are very durable the small size and comparatively slow growth of the species makes its growing for this purposes unattractive.
MANNA GUM .... (*Acacia microbotrya*)	Wheatbelt—near creeks and in granite country	11 in. to 20 in.	A small tree with bushy irregular light green crown Height : 25 ft.	Shade, ornament, manna-gum production	A fast-growing small tree which will make a quick shade while more permanent species are becoming established.

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WINTER DYSENTERY

By J. SHILKIN, B.V.Sc., Assistant Chief Veterinary Surgeon

A FORM of infectious diarrhoea of cattle, accompanied by a marked decline in milk production was reported from the Mundijong area of Western Australia in early September, 1958. The disease spread rapidly, and within a few days, further outbreaks were reported by private veterinary practitioners at Pinjarra, Coolup, Cookernup and Harvey.

Most of the cattle exhibited at the Perth Royal Show, which commenced on September 26, contracted the disease, both beef and dairy breeds being affected. In general, the infection was mild in the case of beef breeds but some dairy cattle were seriously affected.

Subsequently, the disease spread rapidly and extensively, and few herds in the dairying and beef-raising areas in the South-West of the State escaped infection.

PREVIOUS HISTORY

The disease bears a marked similarity to the condition known as "winter dysentery" which had been previously reported from Canada, the U.S.A., Sweden and India.

The first recorded outbreak in Australia occurred near Sydney, N.S.W., in June, 1958. It spread to the South Coast and Hunter Valley districts and thereafter spread widely throughout New South Wales.

During September, 1958, a report from the Director, Division of Animal Industry, Queensland, gave details of an outbreak at the Royal National Exhibition in Brisbane early in August and its subsequent spread in Queensland.

Unofficial reports were also received of similar outbreaks in South Australia and Victoria.

It is unlikely that the disease had been present in Australia for any length of time prior to the outbreaks being recorded in New South Wales.

There is no suspicion attached to the few cattle importations into New South Wales from Great Britain and Canada.

In an effort to trace the source of the entry of the disease into Western Australia, lists were obtained from livestock agents of all cattle imported from the Eastern States since the beginning of the year. Owners of these cattle were then circularised and asked to advise whether any of the animals showed symptoms of diarrhoea subsequent to importation.

From the replies, received, there is no evidence that any of these imported animals was responsible for introducing the disease into this State. Although several either subsequently became affected or were in herds where the disease occurred, the evidence indicated that the infection was most likely contracted at the Royal or later country Shows, or from infection already present in the districts concerned.

SYMPTOMS

Symptoms shown by individual animals commenced with a slight but readily observable watery discharge from the eyes and nose, and loss of appetite. Shortly afterwards, a profuse watery dark green diarrhoea developed, which sometimes contained flecks or large quantities of blood. Diarrhoea or dysentery continued for one or two days then gradually cleared up without treatment. The duration of the illness was usually from three to five days. There was a mild temperature reaction in the initial stages, never more than 104° Fahrenheit, but when the animals were scouring, the temperature was either normal or sub-normal.

Animals of all ages from calves upward were infected. The dry stock appeared to be less susceptible than lactating animals.

An outstanding feature of the disease was its highly infectious nature. Within a matter of days, almost all the cattle in a herd were infected, and usually two to three weeks elapsed between the first appearance and the disappearance of the disease from the herd.

The effect on milk production in dairy herds was severe. In the majority of herds, there was a drop of one-third to one-half of the total production for three or four days, followed by a gradual rise almost to previous levels. Cattle which were in the later stages of lactation rarely returned to production at all.

In New South Wales, transmission of the disease was effected by drenching with faeces, and by the subcutaneous injection of a bacteria-free filtrate and the incubation period was found to vary from two to nine days.

In Western Australia the Veterinary Pathologist successfully transmitted the disease by means of a subcutaneous injection of a bacteria-free filtrate and oral administration of faeces. Results of oral administration of bacteria-free filtrate were negative, as was the oral administration of faeces to a sheep. In both successful transmissions the incubation period was approximately five days.

RECURRENCE POSSIBLE

While cases of the disease have occurred fairly recently in this State, the tendency is for outbreaks to decline and disappear with the advent of high temperatures and dry summer conditions.

From the pattern of the disease in countries outside Australia however, it is possible that it will recur in dairying areas during subsequent winter and spring periods.

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MELILOTUS OR KING ISLAND MELILOT

(*Melilotus indica* (L.) All.)

Melilotus is regarded by some as being a useful plant and condemned by others as a serious weed. It has some value, particularly as a coloniser on calcareous soils, but the high coumarin content of the seeds impart an undesirable taint to farm produce, including grain, meat and milk.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

Melilotus or King Island Melilot

(*Melilotus indica* All.)

MANY people will be surprised to see Melilotus described as a weed, but, besides having certain advantageous properties, it can also prove most undesirable. Originating from Southern Asia and the Mediterranean region, it has spread widely and is now naturalised in many countries, including the southern parts of Australia. Although favouring limestone soils, especially in coastal situations, Melilotus will grow on a variety of soil types and has been found considerable distances inland.

It first gained prominence in Australia as a coloniser on King Island off the coast of Tasmania. Extreme difficulty was being experienced in establishing pastures on sandy soils, but the use of King Island Melilot, which has the nitrogen-fixing characteristic of legumes, enabled poor, exposed soils to be converted into productive pastures. On the other hand, it has a bad reputation for tainting farm produce, an aspect which will be discussed later in the article.

DESCRIPTION

The vernacular name employed depends largely on the attitude towards the plant in the district concerned. King Island Melilot is obviously derived from King Island where the plant proved extremely useful and is the name usually adopted in localities where its value as a forage plant is considered to outweigh its disadvantages. "Hexham Scent," referring to the odour caused by the presence of coumarin is often applied where its weed propensities predominate.

Melitotus indica is an almost hairless, annual, 2-3 ft. high, with erect rather than spreading branches. The leaves consist of three toothed, more or less obovate leaflets. The leaflets of the basal leaves are broader and the central vein is often red in colour.

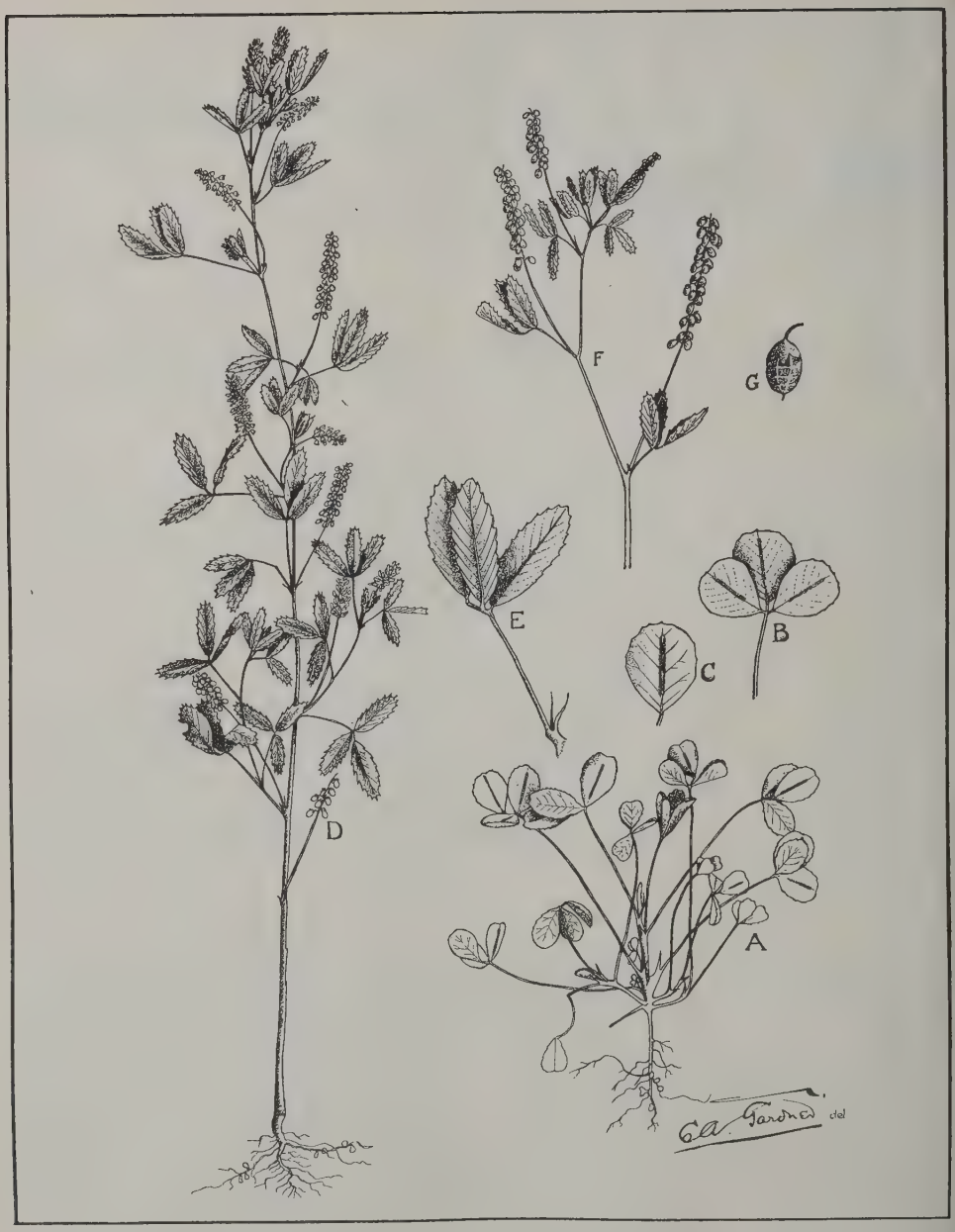
The small yellow pea-shaped flowers are in long-stalked axillary racemes. Nine of the ten stamens are united and the ovary has two ovules. The pod is sub-globular, somewhat compressed, hard and leathery, pendulous, one-seeded, wrinkled with net-like markings and falling without opening.

Flowering occurs in the spring and early summer.

SIGNIFICANCE

As already mentioned, Melitotus is regarded as both a useful plant and a weed. It is undoubtedly hardy and has the soil-improving capacity of the related clovers. The early experience on King Island, where success was obtained with Melilotus when clovers failed, has been repeated in other localities. In South Australia it has been grown successfully on very alkaline, rather salty coastal areas and thrives on the light calcareous soils of Yorke Peninsula.

In the light of recent knowledge concerning trace element deficiencies affecting the growth of clovers, however, Melilotus has been largely superseded as



KING ISLAND MELILOT

(*Melilotus indica* All.)

A—Young plant; B—Leaf; C—Leaflets; D—Mature plant; E—Leaf, showing stipules; F—Fruiting branch; G—Fruit containing a single seed

a pioneer species. Barrel medic must be regarded as a much superior pasture plant for calcareous soils and, despite its burrs, the common burr trefoil is also sown under such conditions. Barrel medic is early maturing and more palatable and nutritious without having the undesirable characteristics of Melilotus.

Melilotus has been naturalised in Western Australia for more than 50 years. It has been recorded from a number of inland agricultural districts but is most prevelant on the coastal limestone country. Conditions, possibly of both soil and climate, are less suitable than in parts of the Eastern States and nowhere in Western Australia has it become a troublesome weed. The possibility of this happening, however, cannot be ruled out entirely, especially on calcareous soils such as in the vicinity of Dongara and Greenough.

The main disadvantage of Melilotus is is the flavour imparted to many items of farm produce by the coumarin present in the plant, particularly in the seeds. Milk cream and butter are liable to be badly tainted if cows graze on the plant, while mutton from sheep eating it has also been affected. The greatest problem in this respect, however, is with grain and grain products, particularly cereals.

Contact with Melilotus seeds for other than a short period will convey the flavour to wheat, barley and oats, and subsequent removal of the seed impurity will not correct the trouble. The flavour is not removed by milling and baking and there have been a number of cases in the Eastern States of bread and biscuits being affected. The Australian Wheat Board will not accept wheat containing Melilotus seed and there is a substantial reduction in the price of contaminated barley.

The problem is not restricted to Australia as shown by the following statement made by Dr. D. W. Kent-Jones, a leading British cereal chemist—"Unfortunately, South America wheat has often, in the last few seasons, been contaminated with Melilotus (*Melilotus indica*). If the grain is either damaged or heated before the Melilotus seed is removed, the scent of the seed may go on to the grain. If the contamination is serious, the wheat then has a hay-like smell which persists in the flour and the bread. In the case of Russian wheat grown in a more temperate climate, the taint is likely to be more marked."

Summing up, Melilotus has some value as a forage and also as a pioneer plant for poor calcareous soils. In this respect, however, experience in Western Australia has shown that barrel medic can be expected to serve the same purpose, while being a better forage plant, and not having the undesirable coumarin content. Although Melilotus so far has shown no strong tendency to become a weed in this State its cultivation is discouraged by the Department, particularly in cereal growing districts.

CONTROL

Where it is desirable to control Melilotus the plants should be prevented from seeding. This can be done by hand-pulling, cultivation or the use of chemicals. As is the case with many legumes, a high percentage of Melilotus seeds are hard and these remain dormant for varying periods. Plants may appear for a number of years after seed formation has been arrested.

The recommended rate of spraying is 6 to 8 oz. acid equivalent of 2,4-D ester or 10 to 12 oz. of 2,4-D amine per acre. Low volume treatment is effective and the best time to spray is when the crop is stooling and six to eight inches high. Later application, particularly when the Melilotus is more than six inches high, is usually much less effective.

If the plant occurs in a crop at the time of harvesting every precaution should be taken to ensure that any seeds of Melilotus are removed without delay and preferably by means of a screen on the harvester. As already mentioned, under some conditions, only a short period of contact is necessary before the cereal becomes tainted.

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REARING ORPHAN ANIMALS

By F. C. WILKINSON, B.V.Sc., Veterinary Surgeon

THE rearing of orphan young is commonly carried out on farms, either from choice as in the case of calves, or as a necessity with foals, lambs, kids, piglets or pups whose mothers have died or for some reason are unable to supply milk for the offspring.

Two methods of rearing orphans are available:—

1. Adoption by a foster-mother, and
2. Artificial rearing by hand-feeding.

It is well known that the young of any species thrives best on milk of its own kind. Therefore, having the orphan adopted by another mother of the same species which has just borne young is undoubtedly the best arrangement. This, however, is not always practicable as a foster-mother is not usually available, and if available, sometimes refuses to adopt the orphan young even after using all known methods of persuasion. In these cases, artificial rearing by hand-feeding should be adopted. If the general principles described in this article are carried out, then perfectly healthy normal aminals can be raised.

ADOPTION BY A FOSTER-MOTHER

Providing an animal which has just borne young is available, adoption is usually fairly easy. In raising calves a foster-mother—usually one that is no longer a useful milker—is commonly used to raise one, two, three or even four calves from other cows. These foster-mothers do not usually object to a new-born calf being placed with them. Sometimes, however, it is necessary to make the young smell like the foster dam's offspring. This is best done by rubbing the cow's afterbirth, if available, over the orphan. This method is also helpful to persuade recently-farrowed sows to adopt young piglets.

However, in sows, often no afterbirth is available, and in this case the best method is to sprinkle the sow, her own offspring and the orphans with a material having a strong odour, such as disinfectant fluid. The sow should be removed for about 20 minutes, while the orphans and her own litter are allowed to mix, then allowed to return to the pen in which her litter and the orphans are running together.

In the older countries where shepherds tend the lambing ewes much more carefully than is the case in Australia, ewes which give birth to dead lambs are often

A FARM-MADE FOSTER-MOTHER
A rack carrying a number of bottles fitted with teats serves a a foster-mother to a group of orphan lambs

persuaded to adopt orphan lambs by draping the dead lamb's skin over the orphan until it has been "mothered." Restraining the ewe until the adopted lamb has sucked is often effective, or the ewe's muzzle and the lamb to be adopted may be lightly smeared with some strong-smelling substance such as Stockholm tar or even kerosene.

Newly-whelped bitches will often adopt another animal's puppies without any special encouragement.

ARTIFICIAL REARING

The problem is more difficult when a foster-mother is not available, but all domestic animals, as with human babies, can be raised with proper care and attention by nursing and artificial feeding. In cattle of course, it is commonplace to rear the calves artificially. As long as the calf is allowed the first milk (colostrum) and then fed regularly with the correct amounts of cow's milk, little difficulty is usually encountered. With most other farm animals only cow's milk is usually available and as the composition of milk from the various farm animals differs quite considerably, cow's milk often has to be altered before being fed.

VARIATIONS IN MILK COMPOSITION

Composition of Milk (Per Cent.) in Various Animals

	Water	Fat	Protein	Sugar
Cow	86.2	4.4*	3.8	4.9
Ewe	83.9	5.2	5.4	4.3
Goat	87.1	4.1	3.7	4.2
Sow	83.0	7.0	6.0	4.0
Dog	79.0	8.5	7.5	3.7
Horse	89.0	1.6	2.7	6.1
Human ..	87.4	3.8	1.6	7.0

* Average figure only. Varies from about 3 per cent. to 6 per cent.

From the table it can be seen that the milk of the ewe, the doe, and the cow are nearly similar in composition and thus cow's milk can be used unchanged for raising lambs and goat kids. The milk of the sow is much richer in fat than that of an average cow, but pigs can be raised successfully on cow's milk which is rich in fat. Orphan piglets are very difficult to rear on skim-milk.

Mare's milk is lower in fat and higher in sugar than cow's milk, but is quite similar to human milk. Foals, therefore, can be raised on cow's milk which is low in butter-fat, and to which sugar has been added or formulas for human babies can be used. The baby mixtures are expensive, but usually better than cow's milk which can cause a chronic diarrhoea if fed before the foal is three months of age. If cow's milk is used, the mixture should be one pint of low-percentage-fat milk, one-quarter of a pint of lime water and a teaspoonful of sugar or glucodin. At two to three months of age, a change to skim-milk with sugar can be gradually made.

Puppies and kittens can be raised on cow's milk or formulas for human babies.

Should whole milk not be available, reconstituted dried butter-milk is an ideal substitute. As it has a high butter-fat content, it should not be used for foals. If one pound of dried butter-milk is mixed with one gallon of water, the resultant fluid differs very little from whole milk.

THE VALUE OF COLOSTRUM

The value of the first milk commonly called colostrum or "beastings" cannot be stressed too much. Colostrum differs from normal milk in that it is a thicker, more viscous, fluid and is yellow in colour. The main attributes of colostrum which make it preferable for new-born animals for the first few days of life are that it is:—

1. **A Rich Source of Vitamin A.**—It contains 10 to 100 times as much Vitamin A as normal milk. Colostrum provides enough Vitamin A so that sufficient can be stored in the liver to provide for maximum growth until the young can obtain Vitamin A from other feed sources.

2. **A Rich Source of Protein.**—The protein mainly occurs in a form called globulin, which can be freely absorbed by the new-born, whereas other proteins cannot.

3. **A Supplier of Antibodies.**—These are protective substances from the mother which help protect the new-born young against bacterial diseases until such time as it is old enough and strong enough to overcome disease organisms to which it is subjected.

An orphan which has had colostrum during the first 24 to 48 hours of its life is always much easier to rear than one which has never had any colostrum.

METHODS OF FEEDING

All animals can be bottle-fed early in life using either calf, lamb, human or doll nipples. At a very early age most animals except lambs and foals can be taught to drink milk from a shallow pan or bucket. Calves can be taught to drink in the first few days of life, while with a little patience, even the youngest of piglets can be taught to drink from a shallow dish. The piglet's mouth and nose should be pushed into the milk, care being taken not to suffocate the animal or to cause fluid

to pass down the windpipe to the lungs. Puppies and kittens can be taught to drink at one to two weeks of age by a similar method.

It is essential that the milk be fresh and warmed to body heat (about 100° F.). Milk not drunk almost immediately should be removed and the implement of feeding sterilized with boiling water before the next feeding.

QUANTITIES TO FEED AND FREQUENCY OF FEEDING

A reliable standard for the quantity of milk to feed daily to young animals is a volume equal in weight to ten per cent. of the body weight of the animals to be fed. For example, a 150 lb. foal would require 15 lb. of milk per day. As one gallon of milk weighs approximately 10 lb., it would mean the foal would require 1½ gallons of milk per day. A young foal should be fed six times a day so it means giving two pints at each feeding.

Judging the amount to feed smaller animals is more difficult. For new-born lambs, three to four tablespoons every four hours is ideal. For piglets and puppies, it is only a matter of one to two teaspoonsful at each feeding. It should be stressed here that **it is hard to starve a young animal, but it is easy to overfeed it.**

The new-born animal should be fed every three hours for the first week of life and about every six hours thereafter. This of course is quite time-consuming, and is difficult to carry out for the whole 24 hours of the day. It should, however, be kept in mind that little, and often at regular intervals is the ideal.

SUPPLEMENTARY SOLID FOOD AND WEANING

The orphan animal should be encouraged to eat solid food as early as possible so that the amount and frequency of milk feeding can be reduced. With grazing animals and pigs, a mixture of crushed wheat (or oats) and dried buttermilk makes an excellent feed. Bran, pollard and skim-milk powder can also be added to make an easily digested supplement to the milk.

Suggested mixtures are:—

	lb.
1. Crushed grain	80
Dried Buttermilk Powder or Dried Skim Milk Powder	20
Salt	½
Bonemeal or bone flour	1
2. Crushed grain	60
Bran or Pollard	20
Dried Buttermilk Powder or Dried Skim Milk Powder	20
Salt	½
Bonemeal or bone flour	1

Pigs will begin eating such a meal at about two weeks of age, especially if a little sugar is added at first. The meal should be made readily available to calves, foals, lambs and kids at about three weeks of age. As they gradually eat more meal, they can be weaned off milk completely. Piglets can be completely weaned on to special meals at one week of age, but on meals suggested they should be fed some milk until they are three to four weeks of age. The weaning of calves, lambs and kids depends on the availability of milk and willingness of the owner to devote time to feeding the orphans. They should be kept on some milk till at least they are four to six weeks old. Foals should not be weaned completely off milk until they are five to six months old if ideal growth is to be obtained.

Good quality hay or young short pasture should be available to all grazing animals during the weaning period, while with all animals it is essential to have readily accessible, cool drinking water always available.

Puppies and kittens should be started with minced, raw or cooked meat when about three weeks of age. As they gradually eat more meat, they can be weaned off milk completely at six weeks of age.

The important consideration during weaning is that **all changes should be made slowly,** gradually decreasing the amount of milk given as the intake of solid food increases.

COMPLICATIONS OF ARTIFICIAL REARING

In general, for the first one or two months of life, the orphan young on an artificial diet will not appear as well-nourished as animals which are reared

naturally on their mothers. They may have digestive upsets resulting in diarrhoea and can contract pneumonia very easily if not housed in warm shelters out of the wind and rain.

Diarrhoea.

This is usually caused by overfeeding, feeding liquids at incorrect temperatures or feeding from contaminated feeding utensils.

If symptoms of diarrhoea develop, the amount of milk should be reduced markedly for 24 to 48 hours. Small quantities of boiled water or lime water should be given in which a drug such as Sulpha G, Terramycin, Animal Formula Powder, or Aureomycin Soluble Powder has been added to overcome any infection. The milk being fed previously should gradually replace the lime water until the animal is back on a normal feeding level.

The addition of vitamins, especially Vitamin A and Vitamin D, also often helps overcome the diarrhoea.

Pneumonia.

This is usually caused by fluids "going the wrong way" into the lungs or by the young being exposed to cold, wet conditions, allowing bacteria to cause an infection of the lungs.

The affected animal becomes dejected, will not drink or eat, breathes heavily, commonly coughs and has a nasal discharge.

Treatment consists of mainly good nursing. Keep the animal warm and try to tempt it to drink fluids. To overcome the infection, injections of sodium sulphamethazine 33⅓ per cent. solution should be given subcutaneously (under the skin). The dosage is 1 cc. for each 5 lb. live weight of the affected orphan. The treatment should be repeated every 24 hours for three days by which time the affected animal should be fully recovered.

It should be always remembered with orphans that the loss of the natural environment can only be made up by extra care and attention during the first few weeks, but provided this is given, then there is no reason why healthy animals should not be reared successfully.

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INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist

The Citrus Red Scale

THE red scale (Aonidiella aurantii Masc.) has a wide distribution over the globe, but tends to be a serious pest in those countries with semi-arid climates such as California, South Africa, Palestine and Australia. The native home of the pest is probably China, but it has been known in Australia for over 70 years and it was from this continent that it was introduced into North America.

It has been described by authors as the most serious insect pest of citrus, and in many countries this is undoubtedly true. In Western Australia it is widely established, but probably owing to climatic and other conditions it is not the major pest in this State that it is on the other side of the continent.

DESCRIPTION

The adult female is an almost circular soft-bodied insect, devoid of all powers of locomotion and protected by a hardened waxy test or scale, reddish-brown in colour and about 1/10th in. across. Like all bugs, to which group the scales or coccids belong, this insect has sucking mouth parts, the sucking tube being produced into a remarkable hair-like organ far exceeding in length the whole body of the scale.

The male coccid is rarely seen, and differs greatly from the female. It has a pair of well-developed wings and a tuft of filamentous threads, forming a kind of tail. It passes its early development covered by a waxy scale, but when maturity is reached it pushes out from under its covering and goes forth in search of a mate. The male scales or coverings differ from those of the females in being rather smaller and oblong instead of circular in shape.

LIFE HISTORY AND HABITS

The red scale, unlike many coccids, does not lay eggs, but gives birth to living young. The young or larvae may remain under the protecting mother scale for a brief period after birth, especially if the weather is cold.

The young scales, on emergence, are only just visible to the naked eye, and look like tiny yellow specks of sulphur. Under a lens they will be seen to have three pairs of functional legs and a pair of feelers or antennae.

As a rule the young or "crawlers" do not migrate very far, but settle down within a few inches of the parent. The active crawling stage may last a few hours or a couple of days, then the mouth parts are inserted into the plant tissue, the antennae and legs are drawn in under the body and the first cottony threads of the covering scale appear. When finally settled down, the red scale remains fixed in position throughout life, with the exception of the winged males.

After imbibing sap for some time the young scale moults its skin and at the same time loses its legs and antennae. It in-

creases considerably in size and adds to the scale covering, then a second moult follows, after which it reaches maturity.

The time required to develop from crawler to adult will vary with the season of the year and the locality. The main

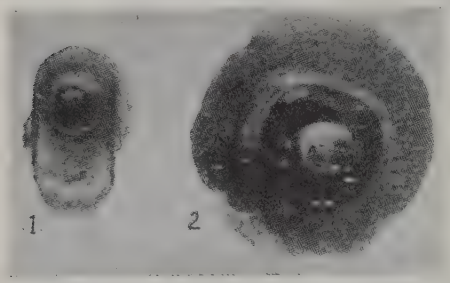

Fig. 1.—(1) Scale of male; (2) Scale of female (enlarged)

breeding season in this State extends from November to May, when several generations may be developed. The exact details are not available for the local breeding rates, but in South Australia it has been shown that it takes about nine weeks in the summer and about 20 weeks in the winter for a newly-hatched female to be ready to give birth to the next generation. After commencing to produce young in the early summer, females may continue to give rise to crawlers for about two months, during which time 150 may be born. This

Fig. 2.—Male of red scale

reproduction may continue on fruits even after they have been picked and held in store. Normally, red scale does not reproduce during the winter. Individuals which have settled down just before the onset of the cold weather may go on developing slowly and be ready to breed the following summer, but many will perish.

METHOD OF DISPERSAL

It is clear from what has already been said about the larval scales that their actual movements and activity have little to do with the spread and distribution of the pest. Factors of importance are the

Fig. 3.—Under side of female red scale showing hair-like mouth parts

transport of infested trees and fruits, picking boxes, etc. Wind is probably the chief agent within an orchard, as "crawlers" are known to have been carried 400 ft. by this means. They have also been known to attach themselves to the bodies of birds and insects and thus be carried far afield.

HOST PLANTS

No complete list of host plants in Western Australia is available, but the fact that in South Africa, no less than 200

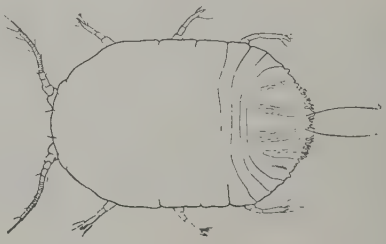

Fig. 4.—Red scale "crawler"

plants have been listed, as carrying the scale, shows that citrus are by no means the only species attacked. Locally, in addition to all types of citrus it has been recorded from figs, mulberries, roses, apples, plums, vines, nectarines, pears, white cedar, castor oil and Zamia palms. Although it is of little economic import-

ance on trees other than citrus, these alternative hosts must be considered when sources of infestation or carry-over in an orchard are being investigated.

TYPE OF INJURY

Red scale attacks all parts of the tree, leaves, fruit, twigs and branches. It may become so thick as to form an incrustation of over-lapping scales. It is the only common citrus scale in the State which actually infests the fruit and consequently it may be easily recognised on this account. Another characteristic is the yellow discoloration which may be seen around the feeding puncture, either on leaves or green fruits. Even when the scale has been rubbed off, this evidence of its presence will persist for some time.

The first indication of the adverse effects of the scale is a yellowing and then a dropping of leaves. In bad infestations, the twigs and young branches may die back, to be followed finally by death of the whole tree. Unlike the black and soft brown scale, the red scale does not secrete honey dew and so the unsightly accumulation of black sooty mould associated with the latter varieties is absent.

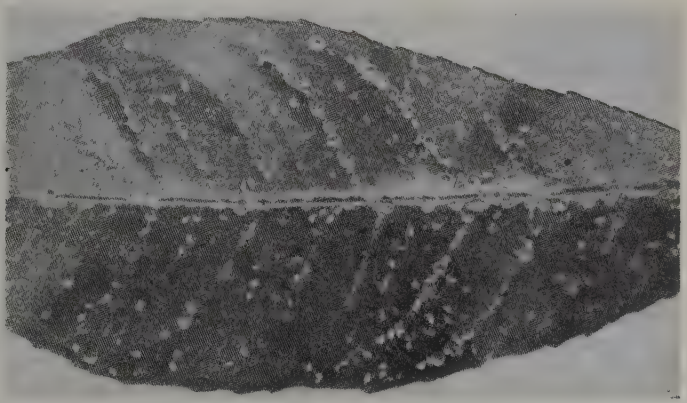

Fig. 5.—Red scale on orange leaf

CONTROL

Two standard control methods are employed against the red scale, namely, spraying and cyanide fumigation. It has been found, more especially in America, that certain individuals have an extraordinary power of resisting cyanide gas and that a resistant variety of scale is being developed.

SPRAYS

White Oil.

The most generally used control in this State is White Oil applied in the late summer at a strength of 1 part of oil to 40 parts of water (2½ gallons per 100 gallons of water or 1 pint to 5 gallons).

Where bad infestations of scale need controlling, two sprays will be found more effective than one. The oil concentration should be halved however (i.e. 1 part to 80 parts of water) and the first spray should be applied in December and the second one about March.

Malathion.

Malathion has been found effective against red scale and is recommended at a concentration of 0.1 per cent. to 0.2 per cent. depending on the severity of the infestation (1½ to 3¼ pints of 50 per cent. Malathion concentrate to 100 gallons of water). Investigations overseas and in the Eastern States suggest that Malathion wettable powders may be more effective than Malathion emulsions, but no comparative tests have been done locally. The wettable powder concentrations suggested are 3 lb of 25 per cent. powder to 100 gallons of water.

Malathion—White Oil Combination.

A mixture of White Oil and Malathion will be found useful against both red scale and the citrus white fly. The combination suggested is—

White Oil—1¼ gallons.

Malathion 50 per cent.—1 pint.

Water—100 gallons.

Parathion.

Parathion has been used effectively against red scale but in some instances it has led to an increase in soft brown scale. Malathion has not had this undesirable effect, and in view of its lower toxicity to humans, Malathion is recommended in preference to Parathion.

Care of Application.

In applying oil and other sprays it is essential to use high pressure equipment. The insecticides depend upon contact for their efficiency and so must reach the centre of the tree and the under surface of the leaves. Spraying should not be done during a heat wave or when trees are

Fig. 6.—An orange tree showing effects of severe scale infestation

Fig. 7.—Lemon heavily infested with red scale

stressing for want of water, otherwise foliage injury may result.

FUMIGATION

Hydrocyanic acid gas is probably the most universally used agent for scale control, although in Western Australia it is now seldom used. It may be generated either by the old pot method in which the gas is evolved through the interaction of potassium or sodium cyanide with sulphuric acid and water, or by means of calcium cyanide which is available in both dust and briquette form. Liquid cyanide has also been used satisfactorily in some countries.

The dosage should be carefully measured according to the size of the tree and the

Fig. 8.—Measuring a tent for determining of fumigation dosage

time of the year. Other precautions to observe are as follows:—

(1) Do not apply fumigation to trees previously treated with copper sprays until a period of six months has elapsed unless the effect on one or two trees has first been tested.

(2) Do not attempt to fumigate trees carrying free moisture, either in the form of rain or dew. Ill-effects may also follow the use of damp sheets.

(3) High temperatures and bright light will increase the risk of foliage injury. (For this reason fumigation is usually done at night.)

(4) Do not fumigate in less than a fortnight after applying an oil spray.

Dosage.—The ingredients are mixed in the following proportions:—

Potassium cyanide—1 oz.
Water—3 fluid oz. (6 tablespoonfuls).
Sulphuric acid—1 fluid oz.

If sodium cyanide is used, the proportion of sulphuric acid should be increased to 1½ oz. and the water reduced to 2 oz.

A glazed earthenware vessel is usually used as a container and the water should be poured in first. The sulphuric acid should then be added very slowly and the pot placed under the fumigation tent near the trunk of the tree.

After the cyanide, wrapped in paper, has been added, the tent should be quickly dropped and the junction with the ground sealed with heaped-up earth.

The amount of fumigant necessary will vary with the size of the tree, and the following tables based upon recommendations of the Queensland Department of Agriculture are included.

The duration of the fumigation is usually 45 minutes

Tents.

The most durable sheets or tents are made from 8 oz. army duck, although lighter material, including medium weight closely woven calico, has been satisfactorily employed. Tents are usually eight-sided and the diameter varies with the size of the trees to be covered. A 36 ft. sheet should be suitable for an average tree 12 ft. in height.

COMBINATION TREATMENTS

Where heavy red scale infestations occur and where a thorough clean up is desired, the application of oil followed by fumigation has been found most successful.

Oil sprays as may be expected are less effective against insects on the wood and interior portion of the trees, whereas the fumigant readily reaches these individuals, while its concentration on the outer parts of the tree may be rather light. It will therefore be seen that spraying and fumigation may be regarded as complementary treatments. The first week in February is

Table 1.—POTASSIUM CYANIDE (45 Minutes Exposure)

Diameter of Tree (feet)

Height of tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
5	1	1	1	1½	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
6	....	1½	1½	2	2	2½	3	4	4	....	....	....	....	....	....	..	....	....	....	6
7	....	1½	1½	2	2½	3	4	4	4	5	....	....	....	....	....	....	....	....	....	7
8	....	....	....	2½	3	3	4	4	5	6	6	6	7	....	....	....	....	....	....	8
9	....	....	....	2½	3	3	4	4	5	5	6	6	7	7	....	....	....	....	....	9
10	....	....	....	3	3	4	4	4	5	5	6	6	7	8	9	....	....	....	....	10
11	....	....	....	....	4	5	5	5	6	6	7	7	8	9	10	....	....	....	....	11
12	....	....	....	....	....	5	5	6	6	6	7	8	8	10	11	12	13	15	17	12
13	....	....	....	....	....	6	6	7	7	7	8	9	9	12	13	14	15	16	18	13
14	....	....	....	....	....	....	6	7	7	8	9	10	11	13	14	15	17	18	18	14
15	....	....	....	....	....	....	....	7	8	8	10	11	12	14	14	16	18	20	20	15
16	....	....	....	....	....	....	....	....	9	10	12	12	13	14	15	17	18	20	21	16
17	....	....	....	....	....	....	....	....	....	12	13	13	14	15	16	18	20	22	22	17
18	....	....	....	....	....	....	....	....	....	....	13	13	15	16	18	20	22	23	24	18
19	....	....	....	....	....	....	....	....	....	....	....	15	16	18	19	21	23	25	25	19
20	....	....	....	....	....	....	....	....	....	....	....	....	17	19	21	23	24	25	26	20
21	....	....	....	....	....	....	....	....	....	....	....	....	19	19	21	23	25	26	27	21
22	....	....	....	....	....	....	....	....	....	....	....	....	....	21	22	24	25	26	27	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Dosage in Ounces

Proportion—Water, 3 ; Sulphuric Acid, 1 ; Potassium Cyanide, 1

about the latest that oil sprays should be applied if scale is bad and clean fruit is desired, for although a heavy kill may be obtained from later sprays, the dead scales may fail to drop before the fruit is harvested. If a following fumigation is contemplated, it has been shown in South Australia, that this may be given a month or two months later with equally satisfactory results.

Table 2.—CYANOGAS DUST (45 Minutes Exposure)

Diameter of Tree (feet)

Height of tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1	1½	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
5	1	1	1½	1½	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
6	1	1½	1½	1½	2	2½	3	4	4	....	....	....	....	....	....	....	....	....	....	6
7	1	1½	1½	2	2½	2½	3½	4	5	5½	....	....	....	....	....	....	....	....	....	7
8	....	1½	1½	2	2½	3	4	4½	5½	6½	7½	8½	10	....	....	....	....	....	....	8
9	....	....	2	2½	2½	4	4½	5	6	7	8½	9½	11	12½	....	....	....	....	....	9
10	....	....	....	2½	3	4	4½	6	7	8	9½	10½	12	14	15½	....	....	....	....	10
11	....	....	....	....	3½	4½	5	6½	7½	9	10	12	13½	15	17	19	....	....	....	11
12	....	....	....	....	3½	4½	6	7	8	10	11	13	14½	16½	18½	20½	23	25	27½	12
13	....	....	....	....	....	....	6	7½	9	10½	12	14	16	18	20	22	24½	27	30	13
14	....	....	....	....	....	....	7	8	9½	11	13	15	17	19	21½	24	26½	29	32	14
15	....	....	....	....	....	....	....	8½	10	12	14	16	18	20½	23	25½	28½	31	34	15
16	....	....	....	....	....	....	....	9	11	13	15	17	19½	22	24½	27½	30½	33½	36½	16
17	....	....	....	....	....	....	....	....	11½	13½	16	18	20½	23	26	29	32	35½	39	17
18	....	....	....	....	....	....	....	....	12½	14½	17	19	22	24½	27½	31	34	37½	41	18
19	....	....	....	....	....	....	....	....	13	15½	18	20½	23	25	29	32½	36	39½	43½	19
20	....	....	....	....	....	....	....	....	13½	16	18½	21½	24½	27½	30½	34	38	42	46	20
21	....	....	....	....	....	....	....	....	....	....	....	22½	25½	29	32½	36	39½	44	48	21
22	....	....	....	....	....	....	....	....	....	....	....	23½	26½	30	34	37½	41½	46	50½	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Dosage in Ounces.

Table 3.—CALCID BRIQUETTES (40 Minutes Exposure)

Diameter of Tree (feet)

Height of tree (feet).	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	1	1	1½	1½	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
5	1	1	1½	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
6	1	1½	1½	2	2½	2½	3	3½	4	....	....	....	....	....	....	....	....	....	....	6
7	1	1½	2	2	2½	3	3½	4	4½	5	....	....	....	....	....	....	....	....	....	7
8	....	1½	2	2½	2½	3	3½	4½	5	5½	5½	6	7	....	....	....	....	....	....	8
9	....	....	2	2½	3	3½	4	5	5½	5½	6	7	8	9	....	....	....	....	....	9
10	....	....	....	2½	3	3½	4½	5	5	6	7	8	9	10	11	....	....	....	....	10
11	....	....	....	....	3½	4	4½	5	6	7	8	9	10	11	12	13	....	....	....	11
12	....	....	....	....	3½	4	5	5	6	7	8	10	11	12	13	14	16	17	19	12
13	....	....	....	....	....	....	6	6	6	7	9	10	11	13	14	16	18	20	22	13
14	....	....	....	....	....	....	6	6	7	8	9	11	12	14	16	17	19	21	23	14
15	....	....	....	....	....	....	....	6	7	8	10	11	13	15	17	19	21	23	25	15
16	....	....	....	....	....	....	....	7	8	9	11	12	14	16	18	20	22	24	27	16
17	....	....	....	....	....	....	....	....	8	10	11	13	15	17	19	21	24	26	29	17
18	....	....	....	....	....	....	....	....	9	10	12	14	16	18	20	22	25	28	30	18
19	....	....	....	....	....	....	....	....	10	11	13	15	17	19	21	24	26	29	32	19
20	....	....	....	....	....	....	....	....	10	11	1 3	15	18	20	22	25	28	31	34	20
21	....	....	....	....	....	....	....	....	....	....	....	16	19	21	24	26	29	32	35	21
22	....	....	....	....	....	....	....	....	....	....	....	17	19	22	25	28	31	34	37	22
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	

Dosage in Number of Briquettes

BIOLOGICAL CONTROL

Exhaustive efforts have been made in many parts of the world to discover effective parasites and predators of the red scale. One giving early promise was a tiny yellow wasp *Aphytis chrysomphali* (Mercet.), collected in China and introduced in Western Australia in 1905. It is widely established locally and in some districts plays a part in keeping the scale population within reasonable bounds.

In February 1943, a further wasp parasite *Comperiella bifasciata* (How.), was introduced through the co-operation of the C.S.I.R.O. and liberations were made at Harvey, Guildford, Parkerville and Gosnells. The local status of this parasite however, has not been assessed.

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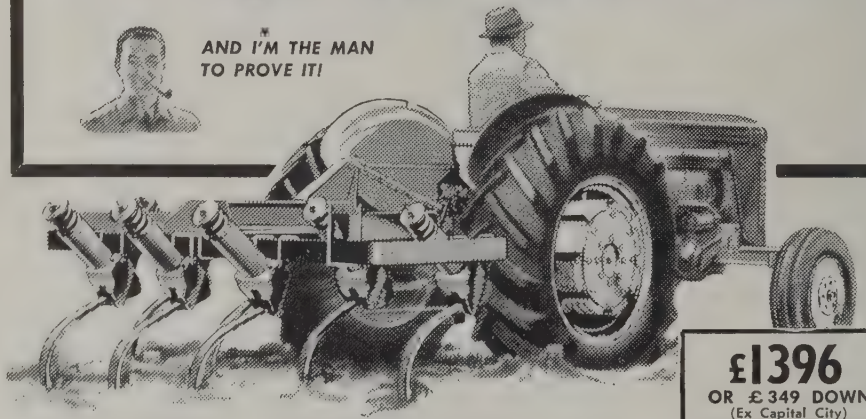

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Fig. 1.—An old photograph showing a donkey waggon loaded with wool, ready to commence the long haul to the port or railhead.

THE DONKEYS ARE DOOMED

By P. J. McDONALD, Regional Vermin Control Officer (Kimberleys)

FROM the turn of the century until about 25 years ago, the patient, hardy donkey played an important role in the pastoral industry of the North-West and Kimberleys. Donkey and camel teams plodded inland from the ports, hauling waggons loaded with food, drink, clothing, tools, fencing wire, building materials, medicines, furniture and all the other items needed on the stations and in the widely-scattered townships. Later, the waggons were hauled back to the ports loaded high with wool, hides and sandalwood.

Waggons drawn by up to 80 donkeys were a common sight on outback trails, the huge vehicles and their loads towering high above a forest of waving ears and a thicket of shaggy legs.

The "donkey mail" provided an infrequent link with the outside world for many isolated sheep and cattle stations, and most pastoral holdings maintained large numbers of donkeys for pack and draught work in their mustering and droving plants.

"PENSIONERS" PROTECTED

On some properties up to 100 donkey mares were kept as "breeders" to provide replacements for the teams. Animals which had given good service were turned out and allowed to roam the country as "pensioners"—and woe betide any "trigger-happy" station hand or traveller found taking potshots at them.

As better roads came into being, the faster-moving motor-trucks gradually ousted the donkeys and camels from the transport business and by the 1930's there were few large teams in operation, which meant that an increasing number of donkeys were freed to run wild.

Better equipped for "living off the country" than other introduced animals, the donkeys multiplied rapidly, roaming the country in large herds which levied heavy toll on the choicest herbage and over-ran the rich river flats and frontage country.

A PEST TAKES OVER

A series of good seasons blanketed the depredations of the donkey herds for some

Fig. 2.—A camel-team carting wool. With the advent of motor transport many camels were released to roam the pastoral areas

years and possibly the first indication that they had increased to pest proportions was in 1936 when Mr. Joe Egan of Ord River Station found it necessary to destroy a large number in his bullock paddock. Here they had increased to such an extent that the cattle were short of feed.

World War II disrupted normal station management work for some years owing to lack of labour and materials, and when re-organisation was put in hand following the cessation of hostilities, the donkey herds had become a serious problem throughout large areas of the North-West and Kimberleys.

With a vast amount of leeway to be made up in rebuilding yards and watering-points after the wartime lack of maintenance, there was insufficient money and labour available on most properties to wage successful warfare against pests and it was not until 1955-56 that the West Kimberley Road Board were successful in having the donkeys gazetted as vermin. They were closely followed by the Halls Creek and Wyndham Road Boards.

WAR ON VERMIN

Once the donkeys were officially proscribed under the Vermin Act, Officers of the Agriculture Protection Board got busy on surveys of the donkey populations, advised station managers where concentrations existed, and offered assistance, where required, in the organisation of destruction methods.

The best results to date have been achieved by teams of donkey-shooters using high-velocity rifles operating at or near water-holes or using four-wheel-drive vehicles to follow the herds.

The latter method can only be used on stations with large areas of open country such as on properties east of the Ord River, in the Derby-Fitzroy area and to the north and south of the Leopold Ranges. Shooting teams employed by two groups of stations in the East Kimberley area have destroyed over 20,000 donkeys during the past three years at a cost of 4s. 6d. a head.

Attempts to offset these costs by the sale of the hides yielded an average return of 9s. per hide after paying expenses, but the skinning slowed down the destruction rate from about 200 to 30 a day and defeated the main object of the campaign.

In the Range country, where wheeled vehicles cannot be used, the shooters work with pack outfits. Spotlights shooting is only successful on very dark nights.

Ex-Army 0.303 rifles with full-length wood stocks are generally used. Sporting rifles are not suitable as they become too hot to hold after about 20 shots have been fired.

Where planned drives have been put into operation, the donkey numbers have been drastically reduced but influxes of the pests still take place from other areas.

As the campaign intensifies, it is expected that donkeys will cease to be a major pest in the pastoral areas.

WILD CAMELS

Although they have not increased in numbers to the same extent as the donkeys, wild camels—descendants of animals which have escaped or been released from camel teams—have become a nuisance in some areas.

They can cause considerable damage to fences, and reports have been received of bull camels savaging sheep congregated at watering-points. Numbers have been shot by pastoralists and Vermin Control Officers and in this case one pest has aided in the destruction of others, as the crisp white fat of the camel's hump is excellent material for poisoning wild dogs and foxes.

Cut into cubes into which strychnine pellets are inserted, the fat is readily eaten by dingoes and foxes, and has an advantage over many other baiting materials, in that it may be stored for long periods without deterioration.

W.A. SHEARING BOOKLET SETS A STANDARD

An illustrated article "Sheep Shearing Technique" which appeared in the West Australian "Journal of Agriculture" is shortly to be translated into Afrikaans and widely distributed throughout South Africa by a firm specialising in shearing machinery.

This was announced recently by the Minister for Agriculture (Mr. L. F. Kelly), who said that Western Australia had given a lead to the Commonwealth eight years ago when Messrs. W. L. McGarry and D. A. Young, with the assistance of the Government photographer, had prepared a "blow by blow" instructional pamphlet designed to improve the standards of shearing tradesmanship.

The booklet was revised as Bulletin No. 2409 in 1957, by the original authors and Mr. M. Butler, also of the Sheep and Wool Branch, and its popularity has been fully maintained.

Mr. Kelly said that requests for permission to reprint "Sheep Shearing Technique" with suitable acknowledgments had been received from New Zealand, Argentina and South Africa. Many thousands of copies had been distributed throughout Australia by commercial firms and it had been used as a standard text book in many agricultural colleges and technical schools.

The blocks of the illustrations had been loaned to the New South Wales Department of Agriculture for the preparation of a similar booklet, and many reports had been received of farmers' sons who became expert shearers by following the illustrations step by step to their conclusion.

It was particularly gratifying, said the Minister, to find that West Australian enterprise was so widely appreciated and he complimented those responsible for the publication on an effort which had greatly enhanced the prestige of this State in the important sphere of wool production.

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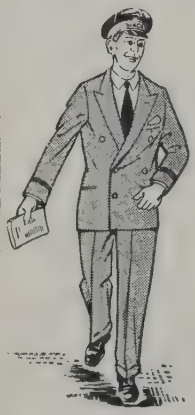

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Fig. 1.—Flax straw being cut and stooked

FLAX TRIALS, 1956-57

ROW SPACING, RATE OF SEEDING AND FERTILISER AT BOYUP BROOK

By H. G. ELLIOTT, Assistant Superintendent of Dairying and F. E. RYAN, Agrostologist

IN overseas countries where flax is grown for fibre it is planted at higher rates of seeding, closer row spacing and higher rates of fertiliser, particularly potash, are used, than in this State. Early in 1956 it was decided to carry out some exploratory trials with fibre flax in the Boyup Brook district, to determine the effects of rates of seeding, drill spacing, together with rates of potash on the yields of flax straw, as well as yield and quality of the fibre produced from the straw with the various treatments. Trials were carried out in 1956-57.

RAINFALL DATA—BOYUP BROOK

Month.	1956.	1957.	Average.
Annual	2,640	2,495	2,723
May-November	2,266	2,106	2,375
September-November	444	244	585

The annual average rainfall in the Boyup Brook district is 27.23 in. of which 23.75 in. occurred during the growing period May to November. A critical period in the growth of the crop occurs between September and November when crops make rapid growth. For this vital period the annual average rainfall is 5.85 in. but the 1956 season falls were below average and in 1957 only 244 points were recorded.

A site was selected for the first trial on Mr. A. Henderson's property at Mayanup. The area was old clover land which had been cropped the previous year to oats for grain. Prior to planting, an excellent control of weeds and pests was obtained.

The following gives the details of the experiment:—

Aim.

To determine the effect of rates of seeding and drill spacing combined with various rates of potash on the yield and quality of flax for fibre.

Site.

In the Boyup Brook district on old clover land which was cropped with cereal in 1955.

Design and Treatments.

The following treatments were combined factorially:—

Drill row spacing—7 in. and 3½ in.

Seeding rates—70, 105 and 140 lb to the acre.

Muriate of Potash—0, 112 and 224 lb. to the acre.

The 18 treatments were replicated three times in a randomised block design.

All treatments received an application of superphosphate plus zinc at the rate of 112 lb to the acre at seeding.

The variety grown was Boyup.

After checking the viability of the seed and also the rate of sowing of the drill, seeding took place in the first week of July, 1956. It was not necessary to spray the crop for either control of pests or weeds during the season.

The results of the experiment are given in the following tables:—

Note:—For various reasons figures obtained in 1956 were not analysed statistically but the results (shown in Tables 1 and 2) suggest possibilities of improvement in yield and fibre production from:—

1. Increase of seeding rates from 70 lb. to 105 lb. per acre.

2. That higher yields may be obtained from closer row spacing, or semi-broadcasting, as opposed to drilling with 7 in. spacing between rows.

3. That increases in yield may be obtained from the use of Muriate of Potash at 1 cwt. per acre as compared with superzinc only.

The plots were influenced by waterlogging and some crops were reduced in yield. Statistical analysis of the results was not attempted but in view of the indications of an increase in yield with higher seeding rates as shown in Table 1 and an advantage of closer row spacing, or semi-broadcasting, over the standard drill sowing with 7 in. spacing as shown in Tables 1 and 2 it was decided to continue with this work. In this respect it is interesting to observe that fibre returns in Table 2 tend to support field yields of straw.

Table 1

A. V. HENDERSON, BOYUP BROOK

Original Straw—(cwts. per acre)

Rate of Seeding (lb. per acre)	70 lb.	105 lb.	140 lb.	Mean
Drilled	30·2	33·2	32·0	31·8
Semi-Broadcast	34·0	32·9	32·5	33·2
112 lb. Super-Zinc	30·5	32·8	31·5	31·6
112 lb. Super-Zinc + Potash 112 lb.	33·4	33·6	32·6	33·2
112 lb. Super-Zinc + Potash 224 lb.	32·4	32·4	32·8	32·5
Mean	32·1	33·0	32·3	....

Table 2

TOTAL YIELDS IN CWTS. PER ACRE

Treatment	Super only		Super + 112 lb. Potash		Super + 224 lb. Potash		Mean	
	Straw	Fibre	Straw	Fibre	Straw	Fibre	Straw	Fibre
Drilled	30·4	3·7	32·5	4·2	32·5	4·3	31·8	4·05
Semi-Broadcast	32·8	4·7	34·2	4·7	32·9	4·5	33·2	4·64
Mean	31·6	4·19	33·3	4·4	32·7	4·4	....	....

FURTHER TRIALS

In 1957 two trials were arranged. These were on the properties of Mr. A. V. Henderson and Mr. W. W. M. Hack, both in the Boyup district. The variety "Wiera" was used on Henderson's and "Boyup" on Hack's as it was considered that these were the strongest-standing straw varieties available in this State.

Unfortunately rust developed and severely affected the results on the property of Mr. Henderson but only slightly affected that of Mr. Hack's. However, both were harvested.

A slight modification of the previous year's treatments was made as only one level of potash was used viz. 2 cwts per acre. Treatments were as follows:—

Design and Treatment.

The following treatments were combined factorially:—

Drilled 7 in. and Broadcasted.

Seeding Rates—70, 105 and 140 lb. per acre.

Muriate of Potash lb. per acre—0, 224.

All plots received 112 lb. per acre of zinc super.

The 12 treatments were replicated 3 times.

Seasonal Conditions.

The season commenced very well with good rains in April and May.

June rains were heavier than normal, but the spring rains after the end of August were very light, and very dry spring conditions with no rain in November were experienced, resulting in below average yields for flax for the district.

RESULTS OF W. W. M. HACK'S TRIAL

Following on the preparation of an excellent seed bed the trial was sown on June 12, 1957, using the variety "Boyup." Tables 3 and 4 give the results obtained.

From the Tables 3 and 4 it will be seen that the average yield of straw from all treatments was 34.3 cwt. per acre. This yielded 11.65 per cent. or 4.00 cwt. of line fibre per acre valued at £60 at the mill. The average length of the straw was 34.1

Table 3

FLAX SPACING AND POTASH EXPERIMENT

W. W. M. Hack, Boyup Brook—1957

Total Yield in Cwts. per Acre

Rate of Seeding	70 lb.		105 lb.		140 lb.		Mean	
	Straw	Fibre	Straw	Fibre	Straw	Fibre	Straw	Fibre
Drilled	31·8	3·78	32·6	3·88	35·0	3·86	35·1	3·84
Semi-Broadcast	33·8	4·09	36·5	4·22	36·3	4·16	35·5	4·15
Super-Zinc 112 lb.	31·6	3·67	34·5	3·97	36·3	4·02	34·1	3·56
Super-Zinc 112 lb. + Potash 112 lb.	35·5	4·20	36·2	4·12	35·0	4·00	35·6	4·11
Mean	33·2	3·93	34·9	4·05	35·6	4·01	34·3	4·00

Table 4

PLANT COUNT AT HARVEST AND LENGTH OF STRAW

Rate of Seeding	70 lb.		105 lb.		140 lb.		Mean	
	No. of Plants	Height in inches	No. of Plants	Height in inches	No. of Plants	Height in inches	No. of Plants	Height in inches
Drilled	146	33·7	170	32·6	178	31·5	165	32·9
Semi-Broadcast	188	36·9	190	35·5	260	35·0	193	35·8
Super-Zinc	169	34·5	169	33·5	191	33·0	176	33·3
Super-Zinc + Potash 112 lb.	169	35·8	191	34·6	186	33·5	183	34·6
Mean	168	35·2	180	34·1	188	33·2	179	34·1

in. and the number of plants per square foot at the time of harvest was 179.

To obtain the results from the various treatments an examination of the figures from these tables permits the following conclusions to be made for this experiment for the the year 1957.

1. Broadcasting is superior to drilling.

2. Rates of seeding of 105 lb. and 140 lb. are superior to 70 lb. per acre.

3. Super and potash fertiliser is superior to super only.

4. The response to potash is greatest at a seeding rate of 140 lb. per acre and there was no difference in straw yield between 105 lb. seeding rate with potash, and 140 lb. without potash.

5. Broadcasting gives greater straw yields than drilling, but the increase in yield is dependent on the rate of seeding. The maximum increase due to broadcasting occurs at a seeding rate of 105 lb. per acre. From Table 3 it is clear that drilling at 140 lb. gives substantial improvement over drilling at 105 or 70 lb. per acre. Broadcasting at 105 lb. per acre gives substantial increase in straw yield over broadcasting at 70 lb. per acre but there is no further improvement at 140 lb. broadcast. Drilling at 140 lb. is superior to broadcasting at 70 lb. but not to broadcasting at 105 lb. per acre.

6. There is also an interaction between application of potash and the method of seeding. It has been noted previously that broadcasting is superior to drilling and that super and potash are superior to super alone. The influence of using potash on the drilled plots is a substantial improvement in yield, but there was little improvement due to potash on the broadcast plots. The broadcast plots receiving super only were superior to the drilled plots receiving super and potash. Hence if seeding is by drilling, applications of potash improve yield, but if seeding is by broadcasting there is no improvement from the use of potash.

Comments.

Straw Yields.

From these results (1957) it is concluded that the best treatment for yields of straw in this experiment is obtained by broadcasting 105 lb. of seed per acre with superzinc at 112 lb. per acre.

Fibre.

An examination of the fibre returns shows no significant differences between individual treatments. This is due in part to an increase in variability of the experimental material in the extraction process with the result that standard error increased from 3.3 per cent. to 6.3 per cent.

It will be noted from Table 3 that the fibre yield per acre generally reflects the straw yield per acre. Examined factorially broadcasting was significantly better than drilling.

Straw Length.

The length of straw varied from 29 in. to 40 in. with a mean from all treatments of 34.1 in. A 36 in. straw is desirable but straw lengths from 30 in. to 40 in. are excellent. Examination of length of straw from each treatment is shown in Table 4. Grouping according to treatment gives the following:—

Table 5

STRAW LENGTH

Treatment	Average Length of Straw
Seed per Acre, 70 lb.	35·2 in.
Seed per Acre, 105 lb.	34·1 in.
Seed per Acre, 140 lb.	33·2 in.
Semi-Broadcasting	35·8 in.
Drilling	32·9 in.
Super + Potash	34·6 in.
Super only	33·3 in.

From Table 5 it is shown that the increased rate of seeding appears to reduce straw length and that broadcasting appears to increase straw length as well as a small increase in length from addition of potash.

RESULTS OF A. V. HENDERSON'S TRIAL

On this property the land was very well prepared and on May 27, 1957, the experiment was planted with the variety "Wiera."

Unfortunately very early in the season rust occurred and by harvesting time, (November 25), it was obvious that the severity of the rust would seriously affect yields of straw and fibre.

Table 6

FLAX SPACING AND POTASH EXPERIMENT

A. Henderson, Boyup Brook

Total Yield in Cwts. per Acre

Rate of Seeding	70 lb.		105 lb.		140 lb.		Mean	
	Straw	Fibre	Straw	Fibre	Straw	Fibre	Straw	Fibre
Drilled	23·5	1·74	24·0	1·69	23·2	1·63	23·6	1·68
Semi-Broadcast	22·2	1·67	21·8	1·51	24·4	1·70	22·8	1·63
Super, 112 lb.	22·9	1·60	22·6	1·63	24·1	1·55	23·2	1·59
Super, 112 lb. + Potash 112 lb.	22·7	1·66	23·2	1·58	23·5	1·78	23·1	1·67
Mean	22·8	1·67	22·9	1·60	23·8	1·67	23·2	1·63

Table 7

PLANT COUNT AT HARVEST AND LENGTH OF STRAW

Rate of Seeding	70 lb.		105 lb.		140 lb.		Mean	
	No. of Plants	Height in inches	No. of Plants	Height in inches	No. of Plants	Height in inches	No. of Plants	Height in inches
Drilled	100	30·6	93	27·9	120	28·0	105	28·3
Semi-Broadcast	150	30·7	143	30·4	146	30·6	147	30·2
Super 112 lb.	130	30·7	123	29·1	139	28·4	131	29·1
Super 112 lb. + Potash 112 lb.	120	30·6	123	30·1	151	30·3	147	30·3
Mean	125	30·6	120	29·1	139	29·3	126	29·7

From the above Tables 6 and 7 it will be seen that the mean yield from all treatments was 23.2 cwt. of straw per acre which yielded only 1.63 cwt. of fibre for an average of 7 per cent.

No significance from the main treatments nor from the factorial arrangement of them was obtained, and no conclusions can be drawn. These experiments were continued in 1958.

DISCUSSION OF 1957 RESULTS

(W. W. M. Hack)

Semi-Broadcasting v. Drilling.

Semi-broadcasting gave higher straw yields than drilling. This is related to the number of plants per square yard of ground surface; at harvest there were more plants in the semi-broadcast plots than in the drilled plots. The number of plants cannot be increased in the drilled plots by increasing seeding rate beyond 140 lb., since there is actually a decrease in plant numbers on the 140 lb. per acre plots from six weeks after sowing to harvest and the maximum survival appears to occur at a drilled seeding rate between 105 lb. per acre and 140 lb. per acre.

Semi-broadcast plots are able to carry a greater number of plants per square foot but maximum numbers are obtained at a seeding rate of 105 lb. per acre.

The superior number of plants on the semi-broadcasts plots as compared with the drilled plots was apparent six weeks after sowing and this resulted in increased straw yields. The importance of this early growth period is therefore emphasised.

Rate of Seeding.

Plant counts at six weeks are proportional to seeding rates but it is significant that even at that stage broadcasting provides more plants than drilling. At harvest the linear relationship between plant numbers and seeding rates is lost, with maximum number of plants at a seeding rate between 105 and 140 lb. per acre on the drilled plots and at 105 lb. per acre on the broadcast plots. The influence of rate of seeding on straw yields is related to

Fig. 2.—A crop of flax at the early flowering stage

plant numbers. Drilling at 140 lb. per acre is superior to drilling at 105 lb. per acre where no potash is used but not when potash at 2 cwt. per acre was applied under the conditions which prevailed for 1957.

This result is also shown by plant numbers per square yard. In semi-broadcast treatments, only one, Treatment G (70 lb. per acre without potash) was inferior to the remainder in yield and this cannot be related to plant numbers at harvest. The yield results however, agree with plant counts at six weeks after sowing.

Potash.

The mean yield of potash treated plots was greater than the no potash plots, but responses were interrelated with method of sowing and rate of seeding.

The influence of potash was mainly on drilled plots, an addition of 2 cwt. per acre of muriate of potash gave significant increases in yield in treatments drilled, at 105 lb. per acre, seeding rate. It was not effective in increasing yields with drilling at 140 lb. per acre. There was an increase in yield on plots broadcast at 70 lb. per acre, but not on other treatments. These differences in yield are not directly related to plant numbers at harvest but bear a relationship to plant numbers six weeks after sowing. Potash increased plant numbers per square yard during the first six weeks.

CONCLUSION (SEASON 1957)

Best treatment for yield of straw was 105 lb. per acre of seed semi-broadcast, with zinc super.

There is evidence that the early growth can play an important part in final yields.

ACKNOWLEDGMENTS

These are made to Mr. A. W. Hobbs, Agricultural Adviser, Bridgetown, Mr. R. Campbell, Field Technician, Bridgetown, Messrs. Henderson and Hack, both farmers, of Boyup Brook, and to the management and staff at the Blackwood Flax Co-op. Co. Mill, for assistance in obtaining these results.

Home-Made Biscuits

By BRENDA CLEEVE

BISCUIT-MAKING is a particularly satisfying form of home cookery because of its infinite variety and because with modern machine-mixing and refrigeration it is a fairly simple matter to keep stocks of biscuits or a variety of mixtures on hand to suit all tastes.

Sweet or plain, crisp and crunchy or soft and smooth-textured, large or small and in fascinating range of shapes, colours and flavours—biscuits are popular with young and old.

SOME GENERAL HINTS

Biscuits of the type in which the mixture is dropped on to a flat tray tend to spread more on a greased surface than an ungreased one. In some mixtures it may not be necessary to grease the tray—experience will teach in this case.

Where greasing is necessary but it is desirable to curb the spreading tendency of the mixture, try applying the grease with a brush, only greasing evenly-spaced patches of the tray

When using a new recipe, try an experimental batch to determine how much space is required for spreading. Biscuits such as brandy snaps which spread to a thin lacy layer need to be at least three inches apart on the tray.

If you have only a limited number of oven trays, use deeper tins such as baking dishes turned upside down. Many people prefer these as the biscuits slide off easily without breaking.

Aluminium foil, which is available quite cheaply, can be used to speed up biscuit cooking. If insufficient baking trays are to hand, cut pieces of foil to the size of each available tray and place the prepared biscuits on the sheets of foil. When one batch of biscuits is cooked, the foil can be slipped off and another piece, already loaded with uncooked mixture, slipped on so that continuous cooking can be carried on without the tedious washing and greasing of trays and waiting for trays to cool. The pieces of foil may be used over and over again until they become too brittle and crack.

Most biscuits should be slightly undercooked, i.e., the surface should be soft and show a slight finger pressure when tested before removing from the oven. Make sure they are not too soft and sticky however, as such biscuits will be too raw. The cooking is completed on the tray while they are being loosened from the surface, and by the time the biscuits are quite cold they will be crisp. If biscuits are kept in the oven until they become crisp they will be hard and uninteresting and may break as they are being removed from the trays.

For really successful baking, all biscuits in each batch should be of even size and thickness. This applies particularly to dropped mixtures and refrigerator biscuits. To ensure an even size and shape in dropped mixtures use a level spoon measure.

Biscuits should be allowed to stand until quite cold before being stored. Careful storage is essential if the special characteristics of each biscuit are to be preserved. Some biscuits will be found to have an improved flavour after storage. For biscuits, especially the crisp type, an airtight container is essential. Crisp and soft varieties require separate containers to prevent the crisp ones becoming soft.

To moisten biscuits of the soft type, place a slice of apple or orange in the storage container, remembering to replace the slices with fresh ones at frequent intervals.

REFRIGERATOR BISCUITS

This is the name commonly given to biscuits made from a mixture which can be prepared at any convenient time and stored in the form of a roll—covered with waxed paper—in the refrigerator. These mixtures do not need to be held in the freezing compartment, but will keep almost indefinitely without deterioration on the ordinary refrigerator shelves.

Most of the biscuits are made by cutting slices ⅛th to 1/16th of an inch thick from the roll of mixture and then cooking them in the normal manner. Any mixture not used may be returned to the "fridge" for use later.

The mixtures are usually kneaded slightly to ensure an even texture throughout and should then be formed into suitably-sized rolls. After wrapping in waxed paper chill thoroughly for not less than four hours, but preferably overnight or longer.

Do not place newly-prepared mixtures on grid-type refrigerator shelves without using a sheet of cardboard or something similar to prevent the grids leaving impressions on the rolls and spoiling the shape of the biscuits.

Use only a very sharp knife for cutting the slices.

Basic Recipe.

This is the same as that used for many biscuits cooked and prepared in the normal way and is one which can be varied by the addition of flavouring ingredients.

Beat 4 oz. of butter or margarine with 2 oz. of sugar until soft and creamy. Add the yolk of an egg and half a teaspoonful of flavouring essence. Stir in 8 oz. of plain flour. Turn the mixture on to a floured board and knead slightly. Form into rolls 2 in. thick. Wrap in waxed paper and chill thoroughly. Cut in thin slices, then place on a greased tray and bake in a moderate oven for eight to ten minutes. The time of cooking will depend on the thickness of the slices and with the chilled mixture it is possible to cut very fine slices which require much less baking time.

To vary this recipe add such flavouring ingredients as ½ cup chopped nuts, 1 tablespoon of finely grated orange or lemon rind. Two ounces of cooled melted chocolate may be beaten into the creamed fat and sugar. Brown sugar may also be substituted for white.

Cinnamon Crisps.

Beat together one cup of margarine or butter and one cup of sugar—use half brown and half white. Add two eggs gradually. Stir in half a cup of chopped nuts. Sift the following ingredients together and stir into the mixture—2½ cups of flour, ¼ teaspoon of baking soda, 3 teaspoons of cinnamon. Turn on to a floured board and knead slightly before forming into rolls and wrapping in greased paper. When thoroughly chilled cut into thin slices and place on baking trays which need not be greased. Bake in a moderate oven seven to ten minutes.

Malt Biscuits

Beat together 4 oz. butter or other fat and 3 oz. sugar. Stir in one dessertspoon of golden syrup and one tablespoon of liquid malt which have been warmed together. Stir in 8 oz. plain flour sifted with a pinch of salt. Lastly stir in one teaspoon of bi-carbonate of soda which has been dissolved in 2 teaspoons of warm milk. Make sure this last mixture is thoroughly and evenly combined with the other ingredients to give a mellow flavour

and an even colour to the baked biscuits. Form into rolls and chill. Bake in a moderate oven eight to ten minutes.

Ginger Biscuits.

Beat together ½ cup of fat and ½ cup of sugar. Add one egg and beat thoroughly. Stir in 2 tablespoons of treacle. Sift together 2½ cups of flour, 2 teaspoons of ginger, ¼ teaspoon of bi-carbonate of soda and a pinch of salt. Form into rolls and chill thoroughly. Cut into slices and bake in a moderate oven for eight to ten minutes.

Cherry and Walnut Biscuits.

Beat 4 oz. butter or margarine with ¾ cup sugar. Add one egg and then one tablespoon of treacle. Stir in ½ cup of chopped cherries and nuts. A little chopped ginger may also be added for extra flavour. Stir in 1½ cups of flour into which has been sifted one teaspoon of bi-carbonate of soda. Form the mixture into rolls and chill. Cut into slices and bake in a slow oven ten to 15 minutes, depending on the thickness of the mixture.

Economical Fruit Biscuits.

Beat one tablespoon of butter or margarine with one cup of brown sugar and one egg. Add one teaspoon of flavouring essence. Stir in ½ cup of chopped nuts or other fruits. Add 2 cups of self-raising flour. Form into rolls about the diameter of a penny and chill. Cut into thin slices and bake in a moderate oven for eight to ten minutes.

SHRINKAGE OF FLOOR BOARDS IN HOT DRY WEATHER

The prolonged dry spell and excessive heat in Southern Australia have caused the shrinkage of flooring boards already laid, especially in recently built houses. The following notes from the C.S.I.R.O. Division of Forests Products may be of assistance to builders and house owners concerned with this problem. If the floors have been laid in accordance with the recommended practice concerning moisture content, they should return to their oriignal condition within the next few months.

However, if the joints are still open after the usual sequence of seasonal movement, the following filling materials may be used:—

(1) If floors are to be waxed, use an oil putty, and for colouring use the colour in oil.

(2) If the floors are to be given a plastic finish, use a water putty, plastic wood, or a mixture of a fine sawdust and glue. For colouring, use a spirit stain for plastic wood, and a water stain for other filling materials.

It should be noted that where cracks over ⅛ in. wide still remain it is preferable to use thin slivers of timber glued into place and dressed off later, rather than attempt to bridge such gaps with any of the fillers mentioned above.

Valuable information on the subject is included in the Division of Forest Products Newsletter No. 238 which emphasises the importance of adopting every means in laying a timber floor to avoid subsequent trouble and costly maintenance. The use of a portable moisture meter to check the condition of the flooring before laying is strongly recommended. A copy of the Newsletter "The Effect of Moisture Change on Wooden Floors" may be obtained from the Building Research Liaison Service, P.O. Box 2807AA, Melbourne, by forwarding a 4d. stamp to cover mailing costs.

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Fig. 1.—A Texas Longhorn, descended from the cattle brought to America by the Spaniards. Hardy and fleet of foot, they were well adapted for harsh range conditions, but their conformation left much to be desired

SANTA GERTRUDIS CATTLE

By J. A. MALLETT

A GROWING number of Australian cattlemen, distributed throughout most of the States of the Commonwealth, are experimenting with Santa Gertrudis Cattle—an American breed evolved from an admixture of five-eighths Shorthorn and three-eighths Zebu blood. Bulls of this new breed sell freely at four-figure prices and are in demand for "grading-up"; pure-bred females are not sold, but remain a closely-guarded monopoly of the parent studs.

The Santa Gertrudis breed was developed on the King Ranch, Texas, U.S.A., and takes its name from the Santa Gertrudis Land Grant originally granted by the Crown of Spain to a prominent Spanish family. The land was eventually purchased by Captain Richard King in 1853.

A COLOURFUL HISTORY

Captain King came to Texas from New Zealand before the Mexican War with a horse and saddle, ten dollars in cash and a boundless store of energy and initiative.

In 1846 he was operating a steamboat on the Rio Grande, transporting American soldiers and supplies to Mexican invasion points. By 1850, King and his partner Mifflin Kenedy owned a score of boats.

In 1852, while riding across the mesquite flats between the Nueces and the Rio Grande with a young lieutenant named Robert E. Lee—later to become world-famous as a Civil War leader—King noted the luxuriant grass along the coastland and conceived the idea of establishing a cattle empire.

What he lacked in practical ranching experience he more than made up for in farsightedness and organising ability. He bought the land and spent most of his savings on water conservation projects, pens and corrals, in purchasing cattle and thoroughbred horses and in hiring an army of Mexican vaqueros. Indians and outlaws had driven off the previous owners of the land, but King had come to stay. In 1854 he married and brought his bride to live on the ranch.

In 1860, with Mifflin Kenedy as his ranching partner, King increased their land holdings and imported Durhams (as Shorthorns were then called) from Kentucky. The Civil War brought increased prosperity to the steamboat business, and in 1868 King and Kenedy halved the ranch between them.

When trail-driving opened up vast new markets after the Civil War, King purchased more land and fenced large tracts so that he could control breeding and improve his stock. When Captain King died in 1885, Robert J. Kleberg Snr. succeeded him in the management of the ranch and later married Alice King, the youngest of Captain King's daughters.

Robert Kleberg was a worthy successor to the man who pioneered this wild and law-

Fig. 2.—A son of Monkey, the foundation sire of the Santa Gertrudis breed

less country. He put down artesian bores; brought scientists from many parts of the world to study local problems; pioneered mechanical land-clearing and cultivation; introduced many pasture plants; commenced dipping to control cattle tick and installed geneticists and veterinarians to tackle the problems of breeding and disease control on the spot.

His son Robert J. Kleberg, jnr., the present president and manager has continued on similar lines until today the King Ranch is a world-famous showplace.

Oil was discovered on the King Ranch about 15 years ago and large quantities are piped to Houston 200 miles away.

The ranch has its own fleet of aircraft; a stud of pure Zebu cattle; a "museum herd" of British Longhorn cattle which has been in existence for over 400 years; a pure bred Jersey herd to supply milk for the army of employees; studs of Afrikander and French Charolais cattle, a stud of chestnut "quarter-horses" and a thoroughbred stud. Mr. Kleberg has twice won the famous Kentucky Derby with horses of his own breeding.

Fig. 3.—Full-fed Santa Gertrudis steers in prime market condition

Fig. 4.—A Santa Gertrudis heifer on the King Ranch, Texas

HISTORY OF THE BREED

The King Ranch is about a million acres in area and has an annual rainfall of about 26 in. most of which falls during two months so that dry conditions prevail for much of the year.

Despite vast sums spent on pasture improvement—the ranch has its own agrostologist—range conditions are very harsh and trying.

Originally, the ranch was stocked with about 40,000 Texas Longhorns, descendants of the cattle which the Spaniards landed at Vera Cruz in 1521.

Tough, wiry and fleet as deer, they flourished under the harsh conditions—but they were slow growing and sadly lacking in beefing quality.

Shorthorns and Hereford bulls were introduced and a grading-up programme was instituted until the ranch was stocked with about 25,000 practically pure-bred Shorthorns and a similar number of high-grade Herefords.

The two breeds were kept separate on areas most suited to them, but although carcass conformation improved, the harsh range conditions resulted in heavy stock losses in bad years—and bad years were only too frequent.

About 47 years ago, a half-bred Shorthorn-Zebu bull was introduced and mated with some of the Shorthorn cows. The progeny of this mating did so well on the range that a further purchase of 52 bulls was made. These carried from three-quarters to seven-eighths of Zebu blood, and a planned breeding programme was put into effect, involving a mass of carefully-compiled records.

One of the best of the new bulls was mated to a blood-red milch cow carrying one-sixteenth of Zebu blood from the first bull introduced. A deep red bull calf resulted from this mating and on maturing he proved to be highly prepotent—stamping his characteristics on all his progeny.

Monkey, as he was called, proved to be the ideal sire and became the founder of a new breed—for by a system of in-and-in and line-breeding his good qualities were perpetuated and today every animal of the Santa Gertrudis breed is descended from him.

MANY GOOD QUALITIES

Santa Gertrudis cattle are red or cherry-red in colour and, because of their genetic make-up, they are highly prepotent, and show a very slight range of variation within the breed.

It is claimed that in its original habitat —the King Ranch, Texas—the breed produces beef that is outstanding in quality

Fig. 5.—A line-up of Santa Gertrudis bulls at a sale in Queensland

and quantity under conditions which made beef-raising uneconomic when Shorthorns and Herefords were used.

The admixture of Zebu blood gives the Santa Gertrudis a high degree of heat-tolerance and pest-resistance so that the animals thrive in tropical areas and withstand hot dry conditions. Under more favourable conditions with moderate temperatures and ample feed and water they are said to achieve greater weights than the straight British beef breeds.

The breeders claim that Santa Gertrudis calves will average 100 lb. more at weaning, than the calves of British breeds under parallel conditions, and that mature cows and steers scale 200 lb. more at the same ages. The carcasses are said to dress out about 3 per cent. heavier than the British breeds and to carry a high proportion of choice cuts and a high percentage of meat to bone.

Investigations now in progress in Australia are designed to compare the performance of the Santa Gertrudis with that of British breeds in this country.

TEMPERAMENT

The Zebu cattle—or Brahmans as they are generally termed in the U.S.A.—have the reputation of being highly nervous and, although they become reasonably docile when handled frequently, they are apt to be wild and intractable under range conditions. Because they can be depended upon to "turn on the fireworks," Brahman cattle are widely used in rodeos and similar shows in the U.S.A.

When he visited the King Ranch in 1950, the chairman of the Australian Meat Board (Mr. J. L. Shute) reported that the Santa Gertrudis cattle appeared more "nervy" than Shorthorns or Herefords although less so than the pure-bred Zebus. Whether the wildness of the Zebu forbears would become a serious disadvantage under outback conditions remains to be seen.

THE KING RANCH IN AUSTRALIA

Following upon a visit to Australia, Robert J. Kleberg, jnr. and a group of

Australian cattlemen, formed King Ranch (Australia) Pty. Ltd., and purchased "Risdon" a 7,500-acre property in Queensland. In August 1952 a draft of 228 Santa Gertrudis cattle (201 females and 27 males) reached Melbourne to form the nucleus of the stud.

At the same time, King Ranch, the same group of graziers and a subsidiary of Swift & Co., the Chicago meat-packers took over a large commercial beef-raising property in Queensland where it is intended to grade up to the existing herds by the use of Santa Gertrudis bulls.

Other importations of Santa Gertrudis cattle were made later, but the embargo on livestock imports resulting from the fear of introducing the disease bluetongue, into Australia halted the influx of the new breed and resulted in keen competition for bulls at the King Ranch (Australia) annual sales.

ATTIC FANS FOR SUMMER COOLING

There are wide areas of inland Australia which enjoy cool still nights after hot days. In areas with similar climatic conditions in the U.S.A., use has been made of a low speed exhaust fan installed in the roof-ceiling space of a dwelling as an economical means of improving summer comfort.

The fan which usually runs for a few hours during the night or until the early hours of the morning, draws air through the house into the roof space, thus—

(a) replacing the hot air inside the house with cool air from outside;

(b) providing movement of cool air to relieve the discomfort of the occupants;

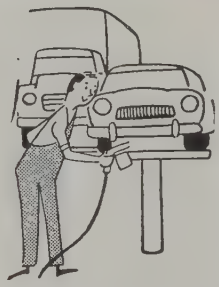
(c) cooling down the structure and thus ensuring a cooler house for the early part of the following day.

The Commonwealth Experimental Building Station has reviewed and assembled information on the installation, operation, and running costs of attic fans, based on overseas experience; and has also conducted tests to assess the results of using such fans under Australian conditions in houses with the same thermal performance as brick houses. The tests showed that the use of an attic fan can be expected to reduce discomfort materially on summer nights, particularly in inland areas. There will also be some reduction in air temperatures indoors during mornings following the operation of the fan.

NSB 7 (9d.) produced by the Station contains the summary of overseas information. The Station's Special Report No. 9 (3s.) describes the tests. Both publications may be obtained either from the Building Research Liaison Service, P.O. Box 2807AA, Melbourne, or from the Commonwealth Experimental Building Station, P.O. Box 30, Chatswood, N.S.W. Prices include postage.

Protect it Yourself . . .

ALL TANKS



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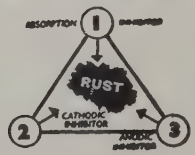

Killrust stops rust three ways, with inhibitors that attack the 3 starting points of rust.

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A SIMPLE METHOD OF THROWING CATTLE

By J. A. MALLETT

WHEN a large bull or bullock—or even a normally mild-mannered cow—has to be put down on the ground and restrained for the purpose of dressing a wound, trimming overgrown hooves or carrying out a surgical operation, the task appears a somewhat formidable one to the average farmer. In reality it is a surprisingly simple matter if he remembers these hints.

The animal is driven into a yard and secured by a halter, or a rope placed round the horns—or around the neck if it is polled. This headrope is held by an assistant or secured by a couple of turns round a rail. It should not be tied as it may need to be slacked off quickly when the animal goes down.

Now take a 30 ft. or 40 ft. length of stout rope and tie one end round the animals neck using a bowline or other non-slip knot. Carry the rope back over the withers and put a half-hitch round the body just behind the forelegs.

Again carry the rope back and make another half-hitch encircling the body just in front of the hip-bones. In the case of a cow, the lower part of the half-hitch should be in front of the udder to avoid bruising that organ.

The long end of the rope is carried back behind the animal and slightly to one side according to the side on which it is to be thrown.

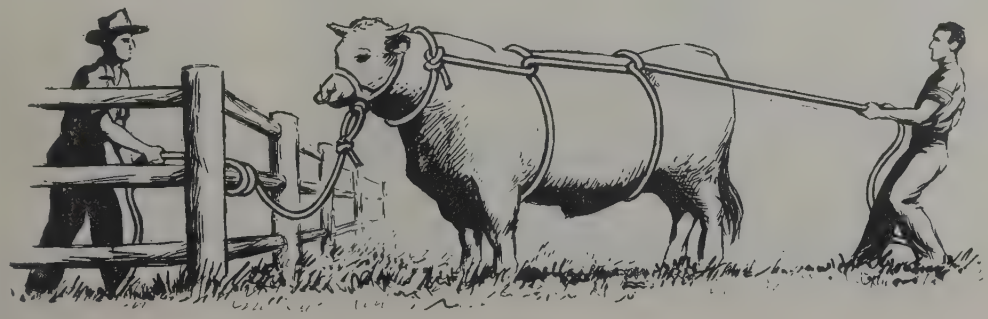
A strong, steady pull on the rope causes the animal to go down gently and without a struggle and it will usually remain motionless as long as a steady pull is maintained on the rope. For lengthy operations, it is a good plan however to take precautions by securing the legs with an extra rope or a set of hobbles.

Known as "Reuff's method," this simple casting device is strikingly effective. Even a big powerful bull will go down smoothly and quietly in a manner which never fails to amaze the inexperienced onlooker.

There are a few variations on the method. Sometimes the rope is tied round the horns and three half-hitches are used, one round the neck and the other two as illustrated. In practice however the method shown in the sketch is quite satisfactory.

I was told recently that it is an improvement to have the rearmost half-hitch passing in front of one hip-bone and behind the opposite hip-bone at the other side, but I have not had an opportunity of testing this. Normally, the rope is in front of both hip-bones.

Many people have asked why this simple method is so effective. Presumably the rope exerts pressure on vital nerve-centres, but I cannot quote any authority for this belief.



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Provides the answer to poor nodulation of clover roots

LIME COATED SEED GIVES THESE ADVANTAGES

Protects essential root nodule bacteria from acidity.

SAVES the cost of liberal broadcasting of lime.

Saves seed waste. Guarantees lime contact for each seed.

Lime dissolves easily in moist soil. Seed germinates quickly.

Costs approximately 1/6 per acre extra. Saves pounds!

Lush growth of clovers depends on the development of a well-nodulated root structure. The problem is to get the essential nitrogen-fixing, nodule-forming bacteria established on the roots. Inoculation with the correct strain of bacteria is necessary, but unless it is protected from acidity in the soil and in superphosphate, the bacteria will die. Lime coating of the seed is the answer, because lime counteracts acidity, and by establishing a suitable environment around the seed, enables the bacteria to thrive and multiply. Last season over 10,000 acres were sown in W.A. to Barrow Linton's lime-coated clover seed, and results proved its effectiveness. Lime coating costs only 4d. lb. extra. Write for sample and literature.

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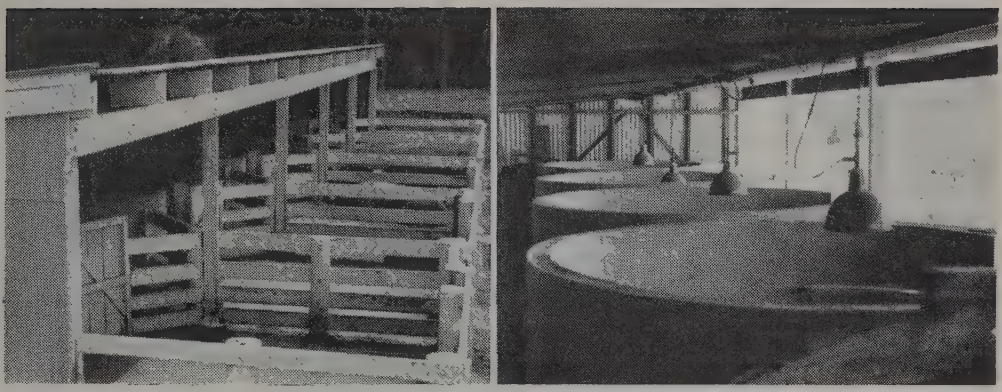


Fig. 1.—A battery of five pens under one roof at the Denmark Research Station. The left-hand photograph shows the general layout of the pens with their separate yards. On the right are the pens with their infra-red lamps above the hovers

ROUND FARROWING HOUSE REDUCES PIGLET LOSSES

By P. BECK, Field Assistant, Dairying Division, and P. GARSTONE, Lecturer,
Muresk Agricultural College

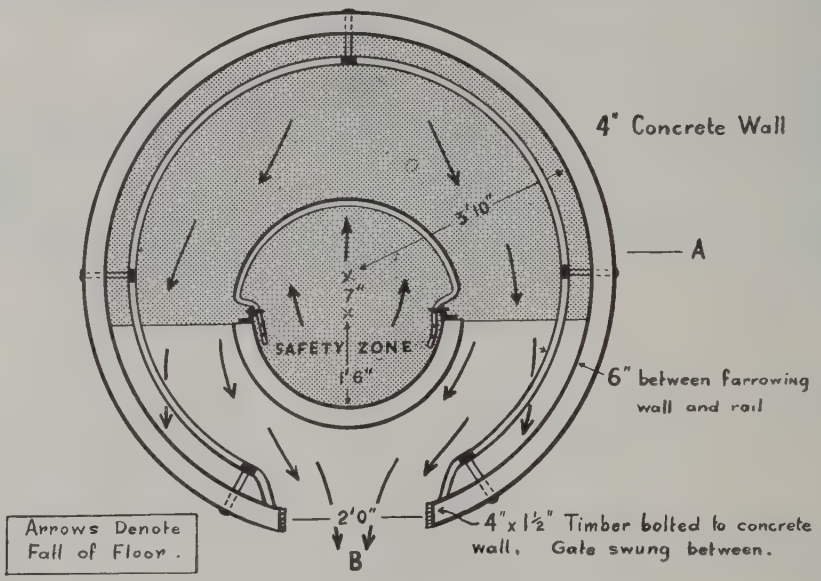
HIGH death rates among young pigs have caused serious concern in the pig-raising industry for many years, and today—despite improved pig husbandry techniques —it is estimated that 20 to 25 per cent. of all pigs born die before they reach weaning age.

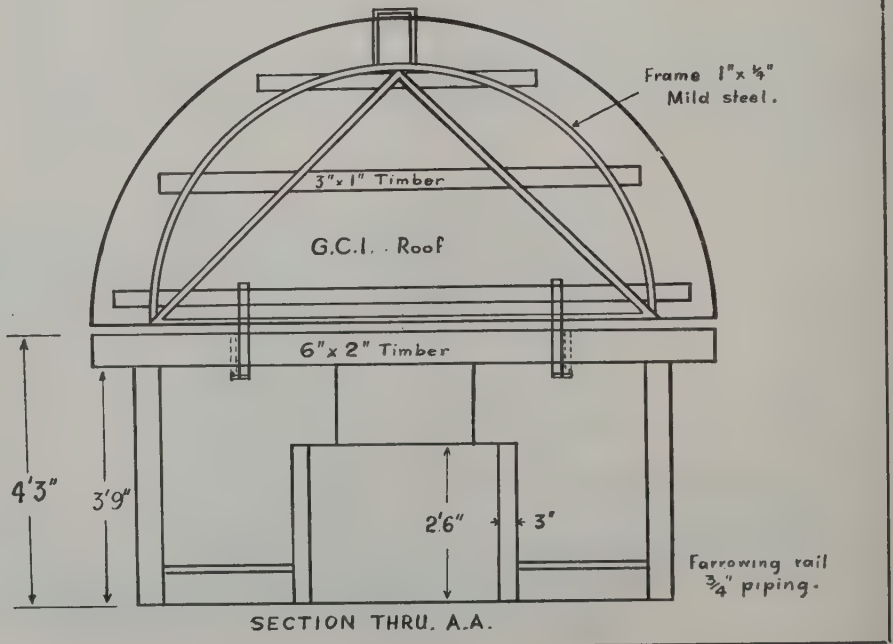
A high proportion of the deaths occur within three or four days of birth. Chilling, with subsequent loss of vigour kills many young pigs; overlying or trampling by the sows kills many more, while the remainder succumb to infections.

Hover boards and various forms of artificial heating have been tested in attempts to prevent chilling, while pens with sloping floors, farrowing rails, farrowing crates and similar devices have been evolved to offset the clumsiness of the sows.

Fig. 2.—Entrance to the farrowing house

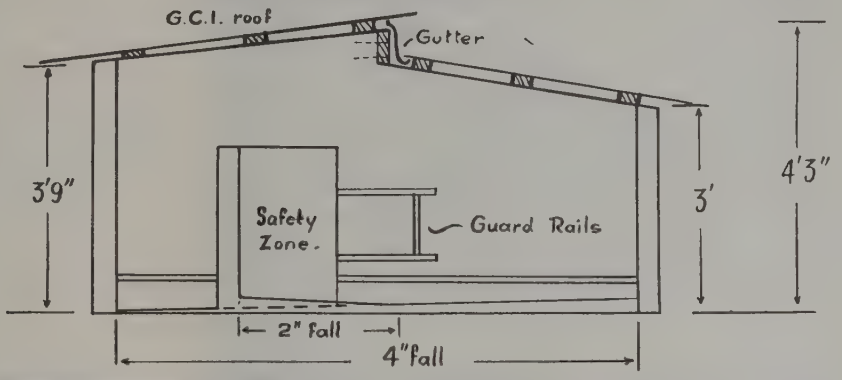
ROUND FARROWING HOUSE



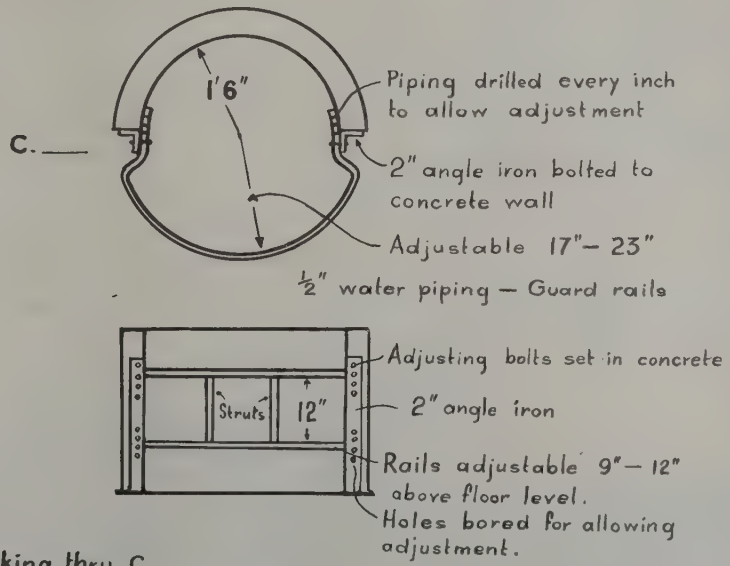


SECTION THRU. A.A.

SECTION B.B.



DETAILS OF GUARD RAILS AROUND SAFETY ZONE...



DETAILS OF FARROWING RAIL ATTACHMENT.

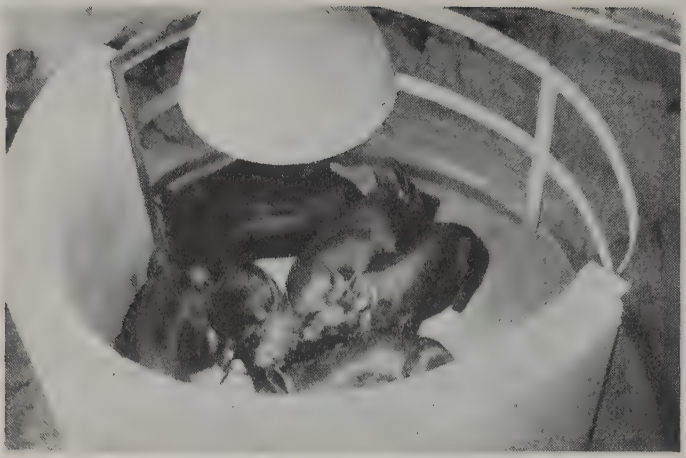


Fig. 3.—Young pigs enjoying the warmth of the hover with its infra-red lamp

A recent successful move to curtail piglet mortality is the round farrowing house developed at the Ruakura Animal Research Station, New Zealand.

The house consists of an exterior circular wall of some good insulating material—usually concrete. This wall forms a complete circle, except for a doorway, and is 4 in. thick with an inside radius of 3 ft. 10 in. A farrowing rail of $\frac{3}{4}$ in. water piping is fitted 6 in. from the inner face of the wall.

Inside the house is another circle set 7 in. off centre towards the front or doorway. The front half of this circle is a 4 in. concrete wall, and the remainder is made up of adjustable guard rails which allow free movement in or out of the inner circle by the young pigs while keeping the sow out. The inner circle or hover has an inside radius of 18 in. and may be heated by an infra-red bulb if desired.

Because of the unusual design of the building, the sow cannot turn round in the farrowing house, and can only lie down in such a position that her back follows the curve of the outer wall and her udder is towards, and in close proximity to, the inner hover or "safety zone." This means that the young pigs have only a short distance to move in order to suckle, and can remain in their safety zone without risk of being trampled or overlain.

Fig. 4.—A battery of farrowing pens at Muresk Agricultural College, each having a separate hinged roof. Right-hand photograph shows roof construction

Fig. 5.—View of pen from above, showing layout

ROOF DESIGN

The design of the roof is important as it obviously plays an important role in controlling the temperature within the pen—and chilling is the cause of heavy mortality among young pigs.

Where there are wide variations between night and day temperatures, the independent unit having its own hinged roof has proved very satisfactory.

Pens of this type at the Muresk Agricultural College have been tested and demonstrated that a temperature of 65 to 70° F. could be maintained in spite of cold nights and changing weather conditions.

At the Denmark Research Station where variations in temperature are less extreme, five round pens under a common roof with infra-red lamps above the hovers are giving good results.

TRIAL RESULTS

In the initial trials at Ruakura in New Zealand, the use of the round farrowing

Fig. 6.—The construction of the round farrowing house compels the sow to lay in this position so that the piglets can suckle or seek the protection of the hover

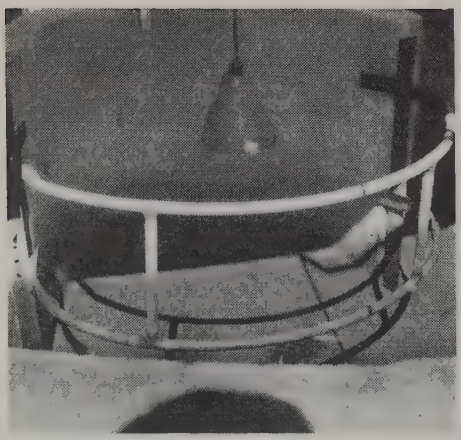


Fig. 7.—The angle-iron holding the guard rails permits adjustments for height or width

pens reduced piglet mortality from 8 per cent. to half of one per cent. Comparable results were obtained on commercial pig-raising establishments in New Zealand.

In Western Australia at the Muresk Agricultural College, the piglet losses have been reduced to one-fith of those sustained in the conventional farrowing pens. At the Denmark Research Station, the losses have been reduced to one-eighth of the previous mortalities.

CONSTRUCTION

Materials Required.

Approximately 17 bags of cement.
3 cu. yds. of ¾ in. bluemetal.
1½ cu. yds. of sand

will be needed to construct the pen and a 7 ft. x 12 ft. concrete yard.

Foundations.

Select a well-drained site and excavate a circular trench with an inner radius of 3 ft. 8 in. and an outer radius of 4 ft. 4in. The foundation should be 8 in. wide at ground level and at least 9 in. deep.

Use a length of iron rod to mark the centre of the circle, with another length 7 in. off centre towards the doorway for the inner circle. Use flat iron as formes for the outer foundation and the inner half-circle foundation and build with rocks and poured concrete. Insert lengths of half-inch mild steel rod projecting 9 in. above the foundations to serve as anchorage for the 4 in. thick walls.

Erect the formes for the walls and mould these with a 3: 2: 1 mix of bluemetal, sand and cement respectively, taking care to insert piping for the farrowing rails as shown in the diagram, also bolts for the doorways, for the angle-iron carrying the adjustable guard-rails for the hover, and for the bearer if a separate roof is to be fitted.

Old ringlock fencing or circles of barbed wire can be used as reinforcement for the walls.

As alternatives to the solid concrete walls, pens have been built of concrete blocks, bricks, and corrugated iron or hardboard bolted to iron frames.

Whatever materials are used however, it is most important that the measurements shown on the diagram should be adhered to, and also that the walls should be well insulated to guard against marked fluctuations in temperature.

Floors.

A solid foundation of broken stone is rammed into position for the flooring and on top of this a layer of empty wine bottles with the necks plugged has been found to give good insulation against ground moisture and to assist in maintaining equable temperatures. The bottles are laid in circles close together in the area shown shaded in the diagram. They are covered by a layer of concrete at least ¾ in. thick.

The floors are sloped as indicated by the arrows in the diagram so that they drain well after being hosed out.

The Hover.

The hover is a semi-circular wall four inches thick with two bolts inserted in each end to carry lengths of 2 in. angle-iron drilled at intervals for the adjustable guard rail. These guard rails may be adjusted up or down and in or out to allow for sows of different sizes.

It is very important that the guard rails are correctly adjusted for each individual sow. Make sure that large sows have sufficent room to lie down and suckle their litters comfortably, and that small sows cannot turn round in the pen or lie with their backs against the guard rails. Incorrect adjustment of the guard rails can lead to losses of piglets.

Farrowing Rail.

The farrowing rail, which encircles the pen 6 in. from the inner surface of the outer wall, is 6 in. above the floor level. It can be made of ½ in. or ¾ in. piping in curved sections linked by T-pieces which are in turn connected to short lengths of ½ in. piping which slip inside the lengths of ¾ in. pipe set in the concrete wall, and are secured on the outside. (See diagram.)

NOT A REARING PEN

The round farrowing house is not designed to serve as a rearing pen, but merely to tide the piglets safely over the dangerous period after birth. In most cases, the sow and litter can be moved into a conventional rearing pen when the young pigs are from one to two weeks old.

For this reason, one round pen is ample for all but very large piggeries.

Remember that while the round pen can help to reduce piglet mortality it cannot succeed without good pig-husbandry. The sow should be in trim, healthy, firm condition prior to farrowing. Over-fatness makes for clumsiness and causes piglet losses from trampling and overlying. Where a sow is in grossly over-fat condition, difficult births can lead to the loss of many piglets.

MURESK AGRICULTURAL COLLEGE

(Department of Agriculture)

Parents are reminded that applications for 1961 admission to Muresk Agricultural College close on 31st December of this year. A preliminary selection of 1961 entrants is made after the Junior results are available early in 1960.

The successful applicants then continue with Sub-Leaving, or higher studies, in 1960.

Before the course can be commenced students must have attained:—

(a) Sub-Leaving Standard in English, Maths. A, Chemistry and Physics (including Magnetism and Electricity).

(b) Junior Standard Bookkeeping.

Should places still exist for 1961 commencement after the preliminary selection early in 1960, they are filled in order of application during 1960, by qualified applicants.

Some places still exist for 1960 commencement and are now being filled by qualified applicants, i.e., those who have or are now taking the correct course at Sub-Leaving or higher standard.

Duration of Course.—Two years.

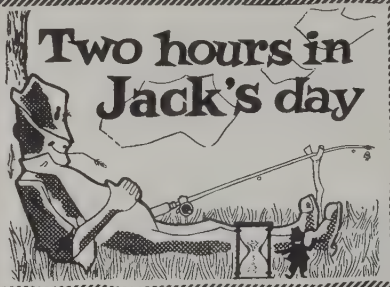
Fees.—Approximately £130 per annum covering full residential charges.

Scholarships.—Department of Agriculture (3), the "Countryman," and J. J. Poynton Memorial (2).

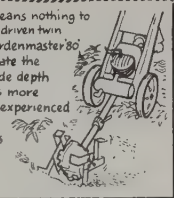
Boarding Allowance.—Most Muresk students are eligible for the Education Department Boarding Allowance (£50 per annum).

Full details of the College are obtainable from the Principal, Muresk Agricultural College, Muresk, W.A., or the Department of Agriculture, Perth.

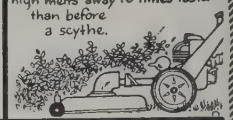
Two hours in Jack's day



A days digging means nothing to Jack. The power driven twin blades of his Gardenmaster 80 break up and aerate the soil to a full spade depth just eight times more quickly than an experienced gardner can do using hand tools - and its no effort.



Without using tools, Jack slips off the digging head and slides on the 18" rotary grass cutter. Overgrowth from 2 to 20 inches high melts away 10 times faster than before a scythe.

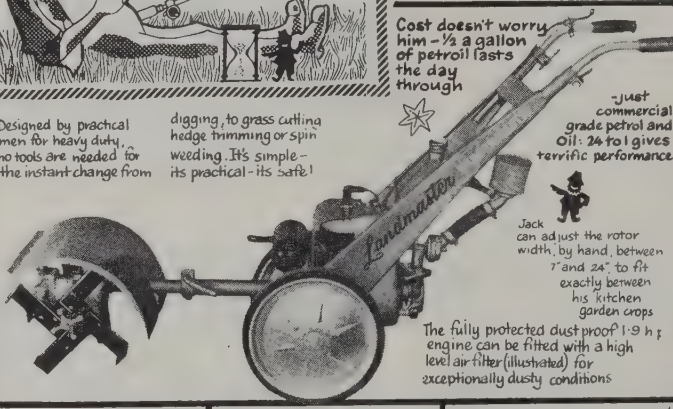


Cost doesn't worry him - ½ a gallon of petroil lasts the day through

-just commercial grade petrol and Oil: 24 to 1 gives terrific performance

Jack did not pay more than £88.10.- for his Gardenmaster 80 complete with hood, blades, tines and weeder. He need only have paid £17.10.- as a deposit. Your dealer offers similar terms. High level air filter is £3.-.- extra

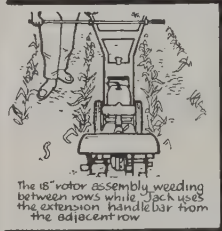
Designed by practical men for heavy duty, no tools are needed for the instant change from digging, to grass cutting hedge trimming or spin weeding. It's simple - its practical - its safe!



Jack can adjust the rotor width, by hand, between 7" and 24" to fit exactly between his kitchen garden crops

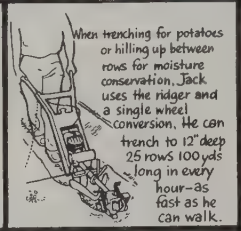
The fully protected dust proof 1·9 h.p. engine can be fitted with a high level air filter (illustrated) for exceptionally dusty conditions

Sun-baked soil or stony ground are easily dealt with by the pick tines (included in standard kit). The next cut with the hoe blades leaves a fine tilth or seed bed

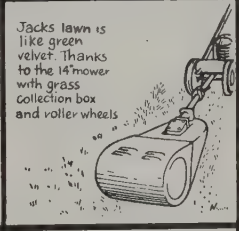


The 18" rotor assembly weeding between rows while Jack uses the extension handle bar from the adjacent row

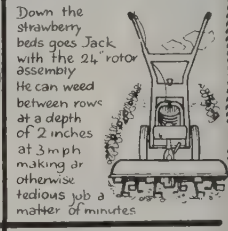
When trenching for potatoes or hilling up between rows for moisture conservation, Jack uses the ridger and a single wheel conversion. He can trench to 12" deep 25 rows 100 yds long in every hour - as fast as he can walk.



Jacks lawn is like green velvet. Thanks to the 14" mower with grass collection box and roller wheels

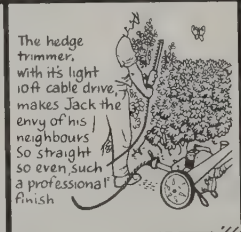


Down the strawberry beds goes Jack with the 24" rotor assembly He can weed between rows at a depth of 2 inches at 3 mph making ar otherwise tedious job a matter of minutes

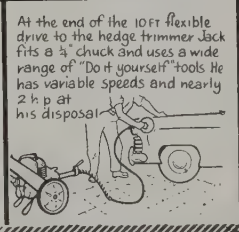


Using the safe, easy recoil starter, young Jack likes to start up the smooth, quiet and easy running engine for his Dad It really is child's play

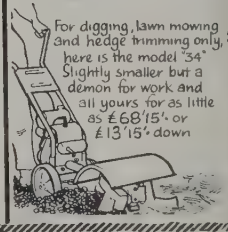
The hedge trimmer, with its light 10 ft cable drive, makes Jack the envy of his neighbours So straight so even, such a professional finish



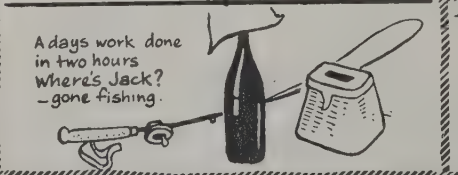
At the end of the 10 FT flexible drive to the hedge trimmer Jack fits a ¼" chuck and uses a wide range of "Do it yourself" tools He has variable speeds and nearly 2 h.p. at his disposal



For digging, lawn mowing and hedge trimming only here is the model "34" Slightly smaller but a demon for work and all yours for as little as £68.15.- or £13.15.- down



A days work done in two hours Where's Jack? - gone fishing.



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Please send me the same literature that first interested Jack in the "Gardenmaster". I will write you again if I want a demonstration on my own land

HEXOESTROL IMPLANTS WITH YEARLING STEERS

(An Experiment at "Cranmore Park," Walebing, 1958)

By N. DAVENPORT, B.Sc. (Agric.), Senior Adviser, Meat Production, and
G. H. NEIL, B.Sc. (Agric.), District Adviser, Moora

THE implantation of pellets containing the growth-promoting hormone, hexoestrol, into the ears of cattle being prepared for slaughter is common practice in the United States of America. In the United Kingdom also, its use is becoming increasingly popular with beef producers. Research in these countries has shown that increased liveweight gains and more efficient feed conversion can be expected at very little cost.

However, their methods of feeding cattle for market differ markedly from ours particularly under the feed-lot system of the U.S.A. For this reason overseas findings may not apply here, at least to the same degree, and in order to assess the usefulness of the practice as an economic aid to our own production it is necessary to carry out research under the typical paddock grazing conditions by which practically all our cattle are marketed.

Investigations using hexoestrol implants which have so far been carried out in Australia have given variable results. In some cases only slight increases in liveweight gain were obtained, while at the other extreme, daily gains have been about half a pound or more and similar to those commonly obtained overseas.

In order to obtain information on the results of the practice in the agricultural areas of this State, an experiment was conducted with yearling steers at "Cranmore Park," Walebing during the period June-September, 1958.

INVESTIGATION AT "CRANMORE PARK," 1958

The market price of lightweight beef normally commences a downward movement at the end of September, and it is the usual practice on this property to market surplus weaners and young steers late in September before the drop in price occurs. The animals are by then sufficiently well finished for the local trade.

On June 12, 20 Shorthorn x Aberdeen Angus steers 12 to 16 months old were eartagged, weighed and divided into two similar groups. They had mostly reached forward store condition following a rather difficult autumn-early winter period.

The cattle in one group were implanted in the back of one ear with 60 mgm. hexoestrol (four gromax "C" pellets each containing 15 mgm.) and the other cattle were untreated to serve as a control group.

Both groups were run together throughout the period and were grazed on improved pastures except for three weeks on young oat crops early in the season.

The experimental period of 96 days ended on September 16 when the cattle were despatched to the Midland Abattoirs for slaughter the following day.

The carcasses were inspected for conformation and finish and individual weights recorded. After chilling overnight, further assessments were made of group differences by carcass measurement as used in the "McMeekan System" of carcass appraisal. The measurements were the depth of eye muscle and its external fat cover at the cut surface between the tenth and eleventh ribs, and also the length of the hind leg.

RESULTS

Growth rates and slaughter data are shown in Table I. Pasture growth in 1958 developed later than usual and liveweight increases were rather low for the first few weeks. However, over the full experimental period of 96 days the average liveweight gain of the treated group was 67 lb. per beast greater than the untreated controls. The carcass weight was 34 lb. extra. These differences were very highly significant.

The average daily liveweight gain of the control group was 2.05 lb. while for the implanted group it was 0.7 lb. higher at 2.75 lb.

Dressing out percentages were virtually the same at 49.7 per cent. and 49.8 per cent. respectively. The carcasses of the implanted group showed less finish than the controls particularly on the legs and shoulders. Internal fat was light and similar for both groups. Generally, the control group had reached marketable condition but the implanted group was not quite ready (see photographs). Fat cover over the eye muscle was significantly less for treated carcasses.

Depth of eye muscle and length of leg were both slightly greater for the treated group but neither difference was significant.

No side effects such as raised tail-head or depressed loin were evident before slaughter.

DISCUSSION

The effect of hexoestrol in promoting liveweight gains increases with age and is at its maximum when the natural growth stimulus is falling off. However, even at the relatively young age of the experimental steers the average liveweight increase of 67 lb. was considerable. Its equivalent in carcass weight viz. 34 lb. at the then current price (200s. per 100 lb.) for lightweight steer beef is equal to £3 8s. for each beast treated.

The cost of the pellets is about one shilling for each beast so that the net gain due to treatment was well worth while, even after allowing for the labour cost of implanting.

Research both in Australia and overseas has shown the necessity for animals to be well forward towards market condition when implanted. As the hormone stimulates meat production at the expense of fat, it follows that if the animals are not sufficiently forward there is the likelihood that they may carry too little fat when marketed even at the present day standards of "finish." This occurred with several of the treated steers which were decidely lacking in fat cover. Due to seasonal conditions the cattle were not as forward at the commencement of the experiment as is generally the case at this time of the year and, although the level of nutrition was quite adequate for the purpose of the experiment (the control group increased 2 lb. per day), the hexoestrol-treated group was still barely ready for market and clearly showed the lesser finish due to treatment.

If the level of grazing had been lower or if the animals had been less forward in condition when implanted, it was obvious that treatment would have resulted in their being unfinished for marketing when required.

Usually the dressing percentage is less with treated animals, that is there is greater loss on slaughter, and this minimises the liveweight gains when considered as carcass weight. In this experiment, however, both groups dressed out at the same percentage of approximately 50 per cent. This percentage is another indication that the beasts were not as forward as usual, as the dressing for such yearlings in other years was 53 per cent. or higher.

The thickness of fat cover over the eye muscle is a guide to the amount of external fat or "finish" of the whole carcass. The measurements showed appreciably less fat cover for the treated carcasses, even greater than when assessed by eye.

The shortness of leg and depth of eye muscle are indicative of meat development, particularly in the more valuable parts of the carcass, but in this experiment the differences between the groups for these two items were small. However it is pointed out that as the treated group carried less fat, their greater carcass weight was primarily due to extra lean meat production and not fat.

In the light of present information, 60 mgm. appears to be the most suitable dose and this is usually suggested. Further

Experimental cattle photographed just before trucking for slaughter. The top picture shows the implanted group; lower picture shows the control group (untreated). Although the control animals show slightly better "finish," the implanted group weighed an average of 67 lb. per beast more (liveweight) and dressed out 34 lb. heavier

investigation is required on this point, however, before firm recommendations can be made. Smaller amounts may result in lower weight gains while larger doses may give rise to objectionable side-effects such as the raising of the tail-head and depression of the loin region. No such effects were seen in this experiment.

Although quite worthwhile weight increases were obtained, this has not always been the case with investigations carried out in other parts of southern Australia. Results have been sufficiently divergent for it to be apparent that more information is necessary before the true value of the practice can be assessed under the varied conditions of the beef raising areas.

However there is already sufficient information to show that treatment should be given only to cattle which are well forward in condition and which will be run under good grazing conditions until slaughtered three to four months from the time of implanting. It is important to confine treatment to cattle being prepared for slaughter.

SUMMARY AND CONCLUSION

During the winter-early spring period, 10 yearling Shorthorn x Aberdeen Angus steers were implanted in the ear with 60 mgm. of hexoestrol (4 pellets each containing 15 mgm.). A similar untreated group was retained as controls. The average weight of both groups was 583 lb. They were run as one group on improved good quality pasture and slaughtered after 96 days.

The average weight of the control group increased by 197 lb. (2.05 lb./day) and of the implanted group by 264 lb. (2.75 lb./per day). The difference of 67 lb. was equal to 34 lb. carcass weight which represented an increase in value per beast of £3 8s. due to treatment.

There was no difference in dressing percentage between the two groups. The carcasses of the treated animals were significantly less finished than the untreated controls and several were below local trade standard in this respect. The extra carcass weight was due primarily to lean meat production and not to fat.

From these results it would appear that some economic gain may be obtained through increased liveweight by the use of hexoestrol implants when preparing yearling beef cattle for slaughter. However, it is necessary for the animals to be well forward in condition and to have ample good quality grazing throughout the treatment period, otherwise some loss in value may occur due to lack of finish.

ACKNOWLEDGMENTS

Acknowledgment is made to Mr. P. Lefroy for his generous help and co-operation throughout the investigation at "Cranmore Park." Thanks are also due to Mr. B. F. Carlin, Agricultural Adviser, Moora, for his assistance; to Mr. R. Rigg of Messrs. J. and A. Patton, who purchased the cattle, for permission to use the carcasses for appraisal, and to the management and staff of the Midland Abattoirs for their co-operation and assistance during slaughter and examination of the carcasses.

Table I
AVERAGE LIVEWEIGHT INCREASES AND SLAUGHTER DATA OF YEARLING STEERS OF AN HEXOESTROL IMPLANT EXPERIMENT AT "CRANMORE PARK," WALEBING, 1958

Treatment	Number of Steers	Liveweight at		Gain in weight		Carcass Weight	Dressing Percentage
		Implanting on June 12	Final Weighing Sept. 16	Total	Daily		
		lb.	lb.	lb.	lb.	lb.	%
Control untreated	10	583	780	197	2·05	388	49·7
Implanted with 60 mgm. Hexoestrol	10	583	847	264	2·75	422	49·8
Difference in favour of implanted group	....	....	....	67*	·70*	34*	0·1 N.S.

* Very highly significant. N.S.—Not significant

Table II
MEASUREMENTS OF THE CARCASSES ACCORDING TO THE "McMEEKAN SYSTEM" OF CARCASS APPRAISAL

Treatment	Length of leg	Depth of eye muscle	Depth of fat over eye muscle
	ins.	mm.	mm.
Control Group	15·7	49	9·7
Implanted Group	16·1	51	7·4
Difference	0·4 N.S.	2 N.S.	2·3*

* Significant. N.S.—Not Significant

W.A. HORTICULTURAL ADVISER TO GO OVERSEAS

The Senior Horticultural Adviser of the Department of Agriculture (Mr. F. Melville) has been loaned to the Commonwealth Government to undertake duties as Assistant Fruit Officer in London this year.

The Minister for Agriculture (Mr. L. F. Kelly) said that Mr. Melville, who was a graduate of the University of W.A., had been engaged on research work in connection with the storage and transport of fruit, particularly in preventing the occurrence of "scald" in Granny Smith apples held in cool stores.

On behalf of the Commonwealth he would investigate technical aspects of the condition and quality of Australian fruit, particularly apples and pears, as it reached the main markets in the United Kingdom, Sweden and Germany. He would study trends in marketing and evaluate the competition which Australian fruits encounter when compared with the produce of other countries.

He would also visit fruit production centres in Britain and the United States and would investigate overseas research into storage and transport problems. Subsequently the information gained would be made available to growers, exporters and inspectors on his return to Western Australia.

Mr. Kelly said that Mr. Melville's survey of the leading production and research centres was being undertaken at the request of the West Australian Fruit Growers' Association who would meet half the costs involved. Special attention would be paid to the fruit industry in California where conditions greatly resembled those in Western Australia.

Weed Research...

by G. A. PEARCE B. Sc. (Agric)
BOTANIST, WEEDS & SEEDS BRANCH.

2.—Weed Control in Vineyards

CHEMICAL weed control trials commenced last year are so promising that it may be possible to do away with the practice of strip-digging in vineyards. Satisfactory weed control which will last throughout the winter and spring can be obtained with chemicals. However, further information is required concerning possible damage to the vines through a build-up of the chemicals in the soil.

The setting of the crop is greatly influenced by the soil moisture relations existing at the time of flowering. Weeds compete strongly for moisture so that their control from this aspect alone is important, particularly in the spring. Weeds also compete for plant nutrients and are often a harbour for insect pests and plant diseases.

STRIP-DIGGING

Strip-digging is carried out because it is not possible to cross-cultivate owing to the trellising system. An offset plough or disc must therefore be used to kill weeds in the trellising row.

This close cultivation is known to cause damage to roots of established vines as well as vine trunks and trellis posts.

Fig. 1.—A row of vines four weeks after treatment with C.M.U.

Fig. 2.—Two pounds C.M.U. per acre 14 weeks after the treatment was applied. Note a few weeds beginning to appear

Strip-digging may take up valuable time at a busy period of the year, and is not always possible because of the condition of the land. It is generally accepted therefore that it would be an advantage to do away with the need of strip-digging.

EFFECTIVE CHEMICALS

Of three chemicals tested, C.M.U. (3-p-chlorophenyl-1, 1-dimethylurea) and Amino triazole gave complete weed control for a period of at least 12 to 14 weeks. After this period odd weeds began to appear but only on plots receiving the lowest rate of C.M.U.

TREATMENTS

Eighty per cent. C.M.U. was applied at the rate of 2, 4 and 8 lb. per acre.

Ninety per cent. Amino triazole was applied at 8 and 16 lb. per acre.

All treatments were applied as a spray in water at the rate of 200 gallons per acre on May 13, 1958.

These treatments were applied within a week of the first winter rains to a strip approximately two feet wide down each row of vines. The strips were first cleaned of any rubbish present, to allow an even application of the chemicals to the surface of the soil. This method was used so that

Fig. 3.—Four pounds C.M.U. per acre 14 weeks after the treatment was applied

Fig. 4.—A high rate of C.M.U. Eight pounds C.M.U. per acre 14 weeks after the treatment was applied. No damage could be detected on the foliage or the berries eight months after the treatment was applied

the top layer of soil could be impregnated with the weedkilling chemicals with the view to killing the seedlings as the seeds germinated.

RESULTS

No weed growth appeared on any plot for a period of 12 weeks. After this time, a few weeds began to appear on the strips treated with 2lb. of C.M.U., but they were very scattered and not in sufficient numbers to cause concern. Both C.M.U. and Amino triazole gradually break down in the soil, and with C.M.U. it is generally accepted that after about eight weeks approximately 40 per cent. of the chemical is still present. This means that the low rate of application of C.M.U. could be sufficiently reduced to allow weed growth towards the end of the season. With the higher rate of C.M.U. sufficient remains to give effective control over the whole season. Both rates of application of Amino triazole remained effective throughout the whole season.

WEEDS CONTROLLED

The weeds controlled included Capeweed *(Cryptostemma calendula)*, wild radish *(Raphanus raphanistrum)*, wild oats *(Avena fatua)*, stagger weed *(Stachys arvensis)*, annual veldt grass *(Ehrharta*

Fig. 5.—Eight pounds Amino triazole per acre 14 weeks after the treatment was applied. No weeds appeared on this treatment throughout the trial

Fig. 6.—Sixteen pounds Amino triazole per acre 14 weeks after the treatment was applied. No damage could be detected on the foliage or the berries eight months after the treatment was applied

longiflora), Barley grass *(Hordeum leporinum),* brome grass *(Bromus spp.)* and Subterranean clover *(Trifolium subterraneum).* It is possible that other winter anual weeds could be more resistant.

EFFECT ON VINES

No attempt was made to avoid spraying the trunks of the vines. The higher rates of C.M.U. and Amino triazole were applied in order to accentuate any detrimental effect these chemicals had on the vines. No symptoms could be detected either on the foliage or the berries.

Although it is generally accepted that both these chemicals once applied to the soil have a limited time during which they remain active, the trials will be continued for at least another season. This will enable any effects due to the accumulation of the chemicals either in the soil or in the vines to be detected.

COST OF TREATMENT

The cost of both chemicals is very economical. Using 4 lb. 80 per cent. C.M.U. or 8 lb. 90 per cent. Amino triazole per acre the cost of the chemical for treating a strip 18 inches wide and 10 chains in length would be approximately 5s. These rates would give complete control. Lower rates of both chemicals would probably give sufficient control to warrant their use.

CONCLUSION

Although the treatments described have given control of the weeds present it is too early to recommend the general use of C.M.U. or Amino triazole in vineyards. At least another season's experience with the application of these chemicals to vines is required to prove that they do not affect the vines.

SUMMARY

(1) A trial was undertaken in an endeavour to control the growth of weeds in a narrow strip along rows of vines. This could do away with the need of strip-digging.

(2) Four pounds of C.M.U. or 8 lb. of Amino triazole per acre applied within a week of the first winter rains gave complete weed control.

(3) The usual winter growing annual weeds such as capeweed, staggerweed, wild radish, wild turnip, wild oats, barley grass, brome grass, veldt grass and subterranean clover were controlled for a period of 14 to 16 weeks.

(4) No harmful effects could be seen on the foliage or berries of the vines throughout the trial and as late as eight months after the treatments were applied.

(5) Because of the possibility of deferred injury to the vines vignerons are recommended not to use these treatments on a large scale for at least another season.

ACKNOWLEDGMENT

It is desired to thank Agricultural Services Pty. Ltd., who kindly supplied the Amino triazole used in this trial.

DAIRY HYGIENE IS IMPORTANT

By D. C. MICKLE, Dairy Instructor, Bunbury

RECENTLY I had the unpleasant job of being a witness in a prosecution case where a dairyman was brought before a magistrate because he failed to do necessary work on dairy premises, which were really quite beyond the pale as to their condition of hygiene.

I, together with my colleagues, dislike taking the only course possible, after all else has failed to bring about improvement, but as long as we are charged with the duty of preserving decent hygienic conditions on dairy farms, we shall carry out that work knowing that this action not only has the support of the consumers of our dairy products, but also of the vast number of dairymen who take a pride in the article they produce and the conditions under which they conduct their dairy.

Like all trends in modern industry, the urge if only by economic pressure, is to improve our product, in production, packaging and marketing. Great strides have been made in these efforts and the dairy farmer, in general, is aware of his responsibility concerning the product of his farm.

It is distasteful to him to learn that it sometimes becomes necessary for those in authority to reprimand anyone engaged in the production of dairy products, on the basis of failure to provide satisfactory cleanliness.

The standards laid down in the model by-laws of the Health Act, controlling dairy premises and their operation are not onerous. Important requirements are:—

(1) A proper milking shed with weatherproof roof, well ventillated, with concrete floor, clean yard, and good concrete drainage leading well away from the milking shed. Of course, concrete yards with a wide apron of concrete at the exit of the milking shed are of considerable help towards maintaining cleaner conditions and reducing the dust menace in summer and muddy conditions in winter.

(2) An enclosed milk room or separating room properly ventilated and fly proofed.

(3) Ample supply of **good** water.

(4) A copper or boiler to provide adequate hot water or steam for washing and sterilising.

(5) Convenient cleansing and cooling facilities.

(6) Maintaining clean equipment and premises.

Advice on these matters is readily available from officers of the Dairying Division of the Department of Agriculture and dairy farmers are assured that those offi-

cers are anxious to assist them in the battle for improved quality of our dairy products. With the severe competition existing in the sale of dairy products and apparently with a limited scope for reduction in cost of production, we must place our faith in producing the best.

And so I address these remarks in particular to those dairymen whose premises are not in the best of condition and remind them that, in these days of more thorough and wider field of education, the younger people on farms are not prepared to happily accept uncongenial conditions in dairy farming. Well aware of this simple fact, many dairy farmers have provided and maintained excellent premises in which it is a pleasure to work. Nevertheless bricks and concrete in themselves are a means to an end and **not** the end themselves. A correct standard of cleanliness is of first importance.

To quote the words of a noted dairy bacteriologist, Professor Orla Jensen, "**Systematic** cleanliness is the golden rule of dairy practice." We have seen this rule so often carried into good effect by the careful dairyman that we know that no injustice is being done when circumstances are such as to give us no alternative other than to take legal proceedings against a dairyman who fails to appreciate that the consumer has a right to be confident in the purity of the dairy product he buys. We aim high in our standard of quality for dairy products and only with the full assistance of the dairymen can such standards be maintained.

FARM WATER SUPPLIES

By K. NEEDHAM, Dairy Cattle Husbandry Officer

AN abundant and continuous supply of pure water is essential where stock are kept. It is particularly important on a dairy property. The water supply must conform to certain standards of both chemical and bacteriological purity. The salt tolerance of various species of animals differs, and within a species it varies under different circumstances, e.g., the difference between a dry cow and one in full production.

Chemically, also, water must be free of certain minerals, or, alternatively, have them present in a form in which they may be precipitated, in order to avoid damage, by pitting and scaling, to utensils and equipment with which the water comes in contact. The mineral content also should be such as to permit of the efficient use of detergents in the cleansing operations. Finally, water should be, as far as possible, free of suspended organic matter, as these substances, apart from their probable unwholesomeness, can cause inconvenience by blockage and contamination.

Bacteriologically, waters must be clean, for the health of both man and beast can be seriously jeopardised by the introduction of pathogenic organisms and parasites, many of which are transmissible by means of water supplies. Such diseases as dysentery, cholera, enteric fever and typhoid can be, and have been, caused by water-borne infection. But, even though the supply may be free of micro-organisms harmful to man and animals, it may still contain species which can be harmful to the dairy industry. These species are capable of causing spoiling of milk and cream with resultant monetary loss to the producer.

Water should be available at as low a temperature as possible, both for consumption and for cooling purposes. It should also be free from unpleasant dissolved gases, such as hydrogen sulphide.

It has been estimated that a cow will consume approximately eight gallons of water per day for maintenance of bodily functions and a further two to three gallons a day for every gallon of milk produced per day. The quantity will vary with the climatic conditions and also according to the type of feed consumed. For washing the udder, dairy utensils, milking machines, dairy buildings, drains and yards, a minimum of 2½ gallons per day per cow is required, but this figure

may easily approach eight to ten gallons per cow for adequate treatment.

The water required for cooling milk and cream will vary, depending upon the temperature of the supply, but it may take five to six gallons for every gallon of milk treated. It seems reasonable to suggest an overall requirement for all these activities of from 20 to 30 gallons a day per milking cow. Over and above this, there will still remain the needs of dry stock (8 gallons per head per day), calves (4 gallons per head per day), pigs (approximately 1½ gallons per head per day) and poultry (6 gallons per 100 birds).

Finally, there are domestic requirements which will vary with individual circumstances, depending upon the size of the family and the locations to which running water for domestic use is provided. In respect of domestic requirements, approximately 25 gallons per person per day should be allowed, and, if a septic system is installed, an additional eight gallons per day per person. Where possible, consideration should be given to the provision of a supply for the home garden. This will vary according to choice and requirements, but it has been estimated that a ¼ acre garden will require an average of 500 gallons per day over the year, with up to 1,000 gallons per day for peak periods during the summer months.

The safe upper limits of total salts in water for stock accepted in this State are:

	Grains Per Gallon.
Poultry	200
Pigs	300
Horses	450
Cattle (Dairy)	500
Cattle (Beef)	700
Sheep	900

(437.5 grains equal 1 oz.).

When the total salts exceed these amounts, only practical tests will show whether the water can be used without ill-effect, because varying conditions vary the allowable maximum amount of soluble salts.

For general domestic use and for human consumption on individual farms, the safe upper limit of total soluble salts is considered to be 150 grains per gallon. Water containing up to 300 grains per gallon may be used for showers and baths, especially if a salt water soap is used, and water containing up to 600 grains per gallon may be used in a septic tank system.

For technical advice on the construction of dams and other water facilities, farmers are advised to consult the Officer-in-Charge, Irrigation, Department of Agriculture, Perth, or the Hydraulic Engineer, Public Works Department, Perth.

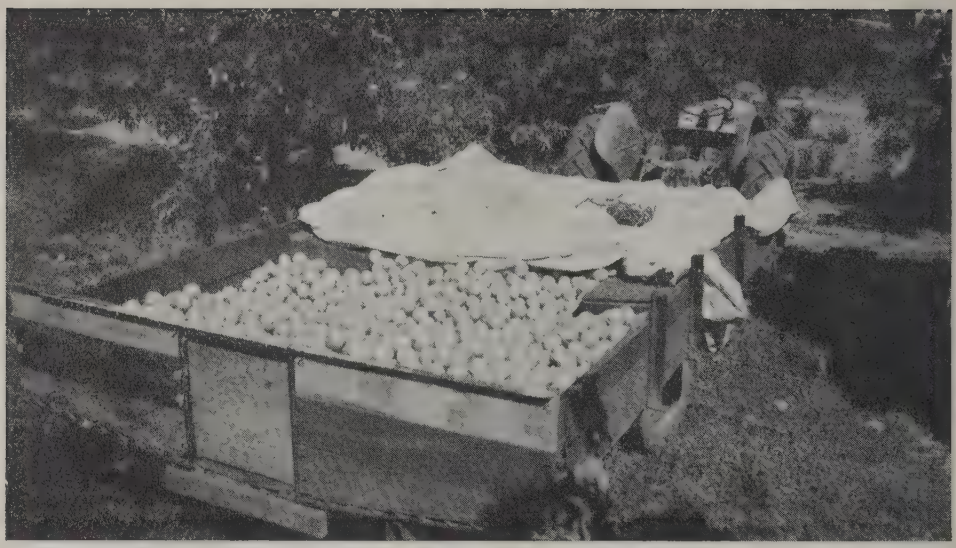
HANDLING THE APPLE CROP

By K. WHITELY, Horticultural Adviser

TOWARDS the end of February the first truck load of export apples usually arrives at Fremantle for inspection before being loaded for shipment to a destination other than the United Kingdom, and is closely followed by many thousands of cases of early-maturing varieties such as Cleopatras, Jonathans and Dunns, for shipment to the United Kingdom and the Continent.

With increasing competition from other apple-growing areas of the world it is essential for West Australian fruit to arrive at its destination in the best possible condition. The final outturn will depend in large measure on the way the fruit is handled and stored from the time it is picked until it arrives at its final destination.

To bring the fruit to its harvest stage the grower has given careful attention to such operations as pruning, spraying, thinning and watering, but the results of these efforts could easily be nullified to a large extent by carelessness at harvesting and during the subsequent period of handling before the fruit reaches the consumer. It is in the hands of the grower to make



A bulk-handling trailer in a West Australian apple orchard

or mar the finished case of fruit during this phase.

There are a number of ways by which the grower can improve his packed fruit. For instance, the general practice in the past has been for the majority of growers to use new export cases in the orchard as picking boxes, and these are then forwarded to the central sheds where they are emptied and subsequently used as export containers. During this process many of them become stained during wet weather, and this not only makes the finished article unattractive, but leaves the stained cases open for rejection by the inspectors.

Although the initial cost of special pine picking boxes (5s. to 6s. each) may seem high, the advantages far outweigh the disadvantages inasmuch as they are easier to handle, simpler to stack and reduce bruising of individual fruits by allowing the full picking bag to be lowered right to the bottom of the box before emptying. Also overfilling of bags and boxes, bumping the picking bag against ladder and knees and the dropping of fruit into boxes all cause bruising of the fruit which leads to the detriment of the final product.

A revolutionary method of handling fruit in the orchard has in recent years come into vogue, namely, bulk-handling. This idea is rapidly gaining favour in many parts of the world, mainly on account of the saving in labour, handling costs and the virtual elimination of bruising. Although it had its beginning as an individual growers device it is rapidly gaining favour with sheds and co-operatives and they too are taking advantage of its commendable features.

Two methods are popular. Firstly, a trailer unit with a holding capacity of 70 to 80 loose boxes of fruit which is hauled from the orchard to the grower's packing shed by tractor. By elevating the front end of the trailer after it has been suitably positioned the fruit will gently slide out through a trapdoor at the back on to the elevator. In the second method bins of 20 to 25 loose box capacity are used and these are handled on a fork lift fitted to the front of the tractor. The bin is deposited on a cradle adjacent to the elevator and takes the place of the hopper. If necessary, filled bins may be stacked until needed.

Whatever method is used to handle the crop the following points are worthy of note:—

Apples from young and light crop trees should be kept separate from fruit from heavy crop trees as they do not keep as well.

During the hottest part of the season, picking-boxes should always be placed on the shady side of the tree or the cases covered with bags or other suitable material. With bulk-handling, tarpaulins should be provided.

Care should be taken, too, to avoid picking sunburnt fruit and the sorters should always be on the alert to reject any fruit showing the signs of sunburn.

Colour requirements must be carefully observed when harvesting red varieties when selective picking is essential. Growers should make themselves acquainted with the requirements before picking commences.

A very important factor and one which seriously affects overseas markets is the presence of San Jose scale on apples submitted for export. Growers should, therefore, be extremely careful to segregate any fruit showing signs of this pest.

To summarise, I would say then that the quality of the fruit exported is largely the responsibility of the grower. The care and attention he gives to picking operations to minimise fruit damage, and the selective picking and segregation of substandard lots will determine to a great extent the quality of the outturn and, at the same time, reduce his rejections to a minimum.

RENOVATION OF IRRIGATED PASTURES

BY AN OFFICER OF THE DAIRYING DIVISION

A HEALTHY irrigated pasture should contain a number of valuable species which reach a peak of production at different seasons and between them maintain a high level of pasture production over most of the year. Factors which influence this ideal condition are many, but water-logging due to insufficient drainage, poor grazing management which allows one species to dominate to the exclusion of others, the compaction of the soil due to trampling by the stock, and pugging of clay soils from winter grazing, spring to mind as important causes. Whatever the cause deterioration occurs on many of our irrigated pastures and frequently within three to five years after establishment.

White clover which should be growing during most of the year is productive only in September to January and again in March. Perennial ryegrass makes a contribution in the spring but is disappointing during the autumn when it is urgently required. Paspalum commences active growth in January and February but tends to run quickly into seed-head and declines in production during March. The months of April and May become very difficult with a heavy demand for milk production to preserve quotas and a severe shortage of paddock feed.

Renovation is necessary to restore vigour to the pasture. The process is one of opening up the soil, breaking through the fibrous roots and breaking up the large root crowns without completely destroying the established species.

A number of different types of implements are used such as a tyne cultivator which penetrates the soil and exerts a lifting action, or a rotary pronged implement which enters the soil on an angle and also has a lifting action. In some cases a rotary hoe fitted with special half-turned points instead of hoe blades has proved quite successful. It may be necessary to cross the paddock in two directions to get a good result but any operation which lifts heavy clods and leaves them on the surface is not very effective since it interferes with subsequent growth and with watering.

The timing of the renovating operation is critical. It is urgent to retain as much grazing land as possible during the period April to June and most farmers are loath to carry out renovation work during this period. If renovation is done after this time it is frequently too late, as the soil is wet and does not break up easily.

In addition, the activity of soil micro-organism is at its lowest ebb in the winter and the advantages of renovation could be easily lost. Pasture improvement is delayed until late spring and the pasture is again dominated by paspalum with some improvement in the white clover. Earlier renovation is desirable. April would appear to be a suitable month but even March is not too soon for such an operation.

Where renovation is done early a vigorous growth of annual species such as subterranean clover and ryegrass can be encouraged which will provide a bulk of grazing five or six weeks after the operation has been carried out. Such renovated pastures grow vigorously during the winter, providing autumn and winter grazing on well-drained areas and resulting in a very greatly increased vigour of the perennial pasture species during the spring and summer months. Early watering of a dry-land paddock in February or beginning of March will help to offset the area thrown out of grazing by the renovation programme.

Several other possibilities exist for stepping up production during this period. Sowing of H1 ryegrass at heavy rates of up to 10 lb. per acre immediately following March or April renovations can provide a bulk of growth within six weeks of sowing. Yarloop clover with its capacity for early autumn growth is also very useful at this time and can be sown into the pasture at rates of 4 to 8 lb. per acre.

In parts of New South Wales heavy seedings of oats at this time of the year have proved very successful and a recent development in the Eastern States has been the sowing in autumn of common vetch to provide autumn and winter grazing.

Very little information is available concerning the use of nitrogenous fertilisers at this period but light applications of sulphate of ammonia in the region of ½ cwt. per acre could be used to stimulate production at this time.

Irrigated pastures are costly to establish and costly to maintain. They must be used intensively if they are to give satisfactory returns. Renovation is a very necessary operation to maintain vigour in such pastures.

MORE ABOUT LUPINOSIS

By H. W. BENNETTS, D.V.Sc., Principal, Animal Health and Nutrition Laboratory

SOME time ago I gave a short radio talk about lupin poisoning and lupinosis—two quite distinct conditions which may cause illness and death in stock eating various species of lupins. Now, as a result of reading the detailed accounts of the German studies of lupinosis published in the late 1880's, I have a somewhat better appreciation of this obscure disease.

Since 1950, lupinosis has become a serious problem in this State, and we have recently intensified our investigations to determine the actual nature or mechanism of this condition. On present knowledge, the only certain recommendation for the control of lupinosis is to advise the farmer to keep his sheep off the lupins, a most unsatisfactory solution, particularly in regions where the lupin is an essential factor in land development and sheep husbandry. We hope that increased knowledge may ultimately lead to a better answer.

LUPIN POISONING

To clarify the position I must first discuss the well understood stock ailment known as lupin poisoning. For many years it has been known that a number of species of lupins contain poisonous chemical compounds in the form of bitter alkaloids, which have been isolated, identified and studied. These are constantly present in the lupins and if taken in by animals in excessive amounts induce acute signs of poisoning—madness, convulsions, etc., which may be fatal. These poisons are not cumulative in their effects. Under our conditions of husbandry, on West Australian blue and New Zealand lupins, losses from lupin poisoning are negligible and present no real problem. (Incidentally, sweet lupins containing only harmless amounts of these toxic alkaloids have been bred and are available.)

A DIFFERENT DISEASE

Lupinosis, however, is quite another story. The symptoms and post-mortem appearances are quite different from those of lupin poisoning. Lupinosis is definitely not due to the lupin alkaloids, but to some unknown factor which is most inconstantly present in the plant. The occurrence of lupinosis, is therefore, most erratic and quite unpredictable. In some instances, sheep mortalities from lupinosis have been as high as 30 per cent. in one year, whereas in other years and on other properties in the same region losses may be negligible. The essential feature of lupinosis is marked liver damage. Affected sheep show dullness, loss of appetite, and jaundice. Deaths may occur within a day or two, or may be delayed for many weeks, depending on the extent of the liver damage. In the more chronic cases, there is a marked loss in bodily condition. Many affected sheep recover, following a change of diet.

Cattle and horses are also susceptible. In this State there have been only occasional cases in cattle, whereas sheep are commonly affected.

Many species of lupins have been known to cause lupinosis. So far as I am aware sweet lupins have not been implicated as yet, but I see no reason why they should not be capable of causing lupinosis as well as the alkaloid-containing varieties (the white, blue and yellow lupins of Europe and the West Australian blue and New Zealand blue lupins grown in this State).

The German reports on lupinosis are very illuminating. In parts of North Germany, as in West Australia, lupins had been used extensively as sheep feed for 20 to 30 years before any occurrence of lupinosis was recognised. Subsequent to 1875, however, lupinosis became the cause of such serious sheep mortalities that in 1880, following the high decree of the Minister for Agriculture, comprehensive investigations were initiated in the provinces of Brandenburg, Pomerania and Silesia. Accounts of these detailed and very thorough studies recently became available through the good offices of our Departmental Librarian, and translations were made by a member of my staff.

I shall now summarise these European findings which are very pertinent to our own problem, although the methods of animal husbandry are so different. In Europe the lupins were cut and stored as hay, which was later fed to animals in barns. Here, of course, sheep are turned into the paddocks when the lupins are ripe and the animals forage for themselves.

Many thousands of acres in the vicinity of the Midland Railway are carrying dense growths of lupins

The German workers at first failed completely in their efforts to reproduce the disease. Subsequently they found that lupin hay from only certain fields in certain seasons was dangerous, whereas lupins cut from other fields could be fed for long periods with complete safety. It was clearly evident that the factor causing lupinosis was most inconstantly present in the lupin plant. On the other hand the hay which caused lupinosis when fed on the farm was found to be highly "toxic". In many instances typical lupinosis was repeatedly produced in experimental sheep fed only ½ lb. or so of this "toxic" plant material. Sheep drenched with alkaline watery extracts of small amounts of similar material also developed typical lupinosis within several days. It was found that the husks were the most dangerous part of the plant although lupinosis could be reproduced, at times, by feeding the seeds or stalks and leaves. Accordingly, most of the detailed feeding trials and chemical investigations were done with husk material. The factor responsible for lupinosis was not isolated or identified, although its effects on the animal were recorded in detail. These, of course, comprised symptoms and post-mortem appearances, including the microscopic changes in the liver and other organs.

A MYSTERY DISEASE

The experimentally produced condition was identical with the naturally occurring one. The German workers, like ourselves, were unable to understand why lupinosis should suddenly become a problem only after a long period of years during which lupins had been fed with complete safety. They could not relate these occurrances to any change in cultural or husbandry practises, nor to any environmental factors influencing the growth of the plants. The nature of the principle causing lupinosis and the factors which determine its presence or absence in the plant still remain an unsolved mystery. For a time the German workers suspected that mould growth was responsible, but were forced to abandon this hypothesis.

SCIENTISTS BAFFLED

For some years now we have been endeavouring to reproduce lupinosis in experimental sheep in order to test our hypothesis of the actual nature of the condition in the terms of modern knowledge of pathology and biochemistry. We had been baffled because our feeding trials gave consistently negative results. The explanation now seems clear. If only some lupin plants are dangerous it is obvious that it will be difficult to locate really toxic plant material even in paddocks where many sheep have died from lupinosis. We are now concentrating on collecting and testing husk material obtained from such paddocks, preferably small ones.

In the meantime, the problem becomes more disturbing and if possible, more baffling and unpredictable. For the first time this year, for example, we confirmed the occurrence of lupinosis in sucker lambs eating well grown **green** plants and in cattle fed with hay, cut green. Previously we had believed that only the mature dry lupin plant was implicated. In that connection the German workers found that hay cut when the plants were mature or even half ripe was much more dangerous than hay cut at flowering, which seldom caused lupinosis. I have been asked on many occasions if ensiled lupins are capable of causing lupinosis. So far as I am aware there is no definite information on this point. Until further evidence is available it would be foolish to offer any opinion except that caution should be observed in the feeding of lupin silage to stock pending further experience. Although the lupin is very useful in the development of light land and has great value as a fodder for sheep it is in some respects an unpredictable plant. In particular we must learn more about the nature and real cause of lupinosis if the plant is to be used with confidence.

FARMERS CAN HELP

The crux of our difficulty in the further investigation of lupinosis is the failure to obtain plant material which will reproduce the condition when fed to experimental animals. Perhaps some of our farmer friends may assist by supplying lupin husk from likely sources or, even better, lupin hay or silage should these be implicated.

CHANGING PRACTICES IN TOBACCO GROWING IN WESTERN AUSTRALIA

By NORMAN HALSE, Research Officer, Plant Research Division

ALTHOUGH not a major crop in Australia, tobacco is of considerable importance. Every pound of tobacco that is grown in Australia means a pound less that has to be imported and usually paid for in dollars.

Partly as a result of a Commonwealth Government policy and partly due to conditions in the industry, tobacco production in Australia has increased considerably in recent years. Consequently there is an increasing proportion of Australian tobacco in Australian-manufactured cigarettes. In order to avoid any decline in quality of these cigarettes it has been necessary to intensify research into factors affecting the smoking quality of Australian-grown tobacco leaf.

A tobacco plantation at Manjimup

I would like to briefly outline some of the changes which are taking place in tobacco growing at Manjimup in Western Australia as a result of the emphasis now placed on smoking quality.

One of the most serious faults of Western Australian tobacco concerns the mineral constituents in the leaf. These are the chemical elements which have been absorbed by the tobacco plant from the soil. To a considerable extent they determine the burning or smoking quality of the leaf. Tobacco grown on Western Australian soils tends to have an unfavourable balance of these elements, some are present in too great a quantity and some in too small a quantity.

One element which is often present in excess is chlorine. This is absorbed from the soil as sodium chloride, or common salt. Some soils, low-lying swampy areas in particular, contain large quantities of salt, and tobacco grown on these areas is of poor quality. By avoiding such patches of known salt concentration tobacco growers are attempting to reduce the amount of chlorine in their tobacco leaf.

Tobacco growers are also taking steps to modify their product by stepping up the level of elements present in too small

a quantity. The most important of these elements is potash. In the current season, growers will be using a new type of fertiliser for the first time. This fertiliser contains a high proportion of potash and will help to increase the level of this element to what is considered necessary for good smoking quality tobacco leaf.

In order to grow good quality tobacco leaf it is also necessary to control the soil moisture throughout the growing period. In the past Western Australian growers have relied on stored soil moisture plus occasional summer rains. They were thus at the mercy of the elements and in unfavourable seasons a large proportion of the leaf grown was of unmarketable quality.

However most progressive tobacco growers are now irrigating their tobacco and by exercising control over the soil moisture they are able to ensure a better and more consistent leaf quality. The best source of irrigation water is from dams which store water from surface run-off only. This water contains very little salt and is quite suitable for tobacco irrigation. It should be realised that water with only as much salt in it as Perth scheme water is too salty for the irrigation of good quality tobacco.

PROGRESS IN DOUBLEGEE CONTROL

By G. A. PEARCE, Botanist, Weeds and Seeds Branch

DOUBLEGEE is probably the most troublesome weed in Western Australia. At the present time it is not possible to suggest any economical treatment which will effectively control doublegee over large areas, either by the application of chemicals, or by cultural treatments. It may be reasoned therefore that no progress has been made in the search for a method of controlling this weed. However this is not so, even though the information so far obtained has been mostly of a negative nature.

During the past six years, trials have been undertaken each year to test new chemicals for their effectiveness against doublegee. In that time some 20 different chemicals have been used at various rates of application without a great deal of success. Included in the chemicals tested have been many lines specially formulated along with five different types of 2,4-D as well as the various butyric derivatives which have caused so much interest during the past two years.

In the southern parts of the wheat and sheep areas, say south of Carnamah, the results with these chemicals have mostly been the same. Initial symptoms of hormone-like chemicals develop quickly, the leaves twist, a swelling appears at the base of the leaves and plant growth is greatly retarded if not stopped completely. This condition of the plants continues often for three or four weeks, but then the doublegee appears to shake off the ill-effects and begins to make new growth. If the plants are resprayed at this critical stage, the renewal of growth is usually only retarded for a further three or four weeks.

In the northern parts of the State, trials have often given excellent results with relatively low rates of the commonly used 2,4-D derivatives. Farmers also have reported on numerous occasions obtaining good control of doublegee in these northern areas. In most of these cases high proportion of plants are killed, yet sufficient doublegees often survive to enable new seeds to be formed. This means that though the growth of the doublegee has been checked during the one season no progress has been made towards eventual eradication. Another problem with doublegee is that not only is a large quantity of seed formed early in the plant's life, but that a large proportion of this seed can remain dormant in the soil over a period of many years.

The question could quite easily be asked what approach should now be made in an endeavour to solve this doublegee problem.

From the results of our trials it would appear that under certain conditions reasonable control of doublegee can be obtained using chemicals now available.

The doublegees which have always given the most favourable reaction have been those making active growth before the treatments were applied. It is thought that this rate of growth may be closely connected with differences in temperature at various centres. The difference in the average daily temperature between Merredin and Chapman over the three months June, July, August is 5.4; however if this difference fluctuates around the critical temperature at which growth will be made, then the temperature factor could be extremely important.

What is happening to the chemical after it is absorbed by the doublegee plant? That is the burning question at the present time.

To help answer this question, equipment is now being planned to enable weed plants such as doublegee to be grown under controlled conditions. It is hoped that the information obtained will give some lead to a practical method of controlling the doublegee.

SOME USES OF RADIO ISOTOPES IN AGRICULTURE

By E. N. FITZPATRICK, Plant Research Division

IN recent years, radio active forms of elements such as phosphorus, sulphur, calcium, iron and manganese have been produced at nuclear reactors and made available to research workers. These radio active forms are called radio isotopes.

Some radio isotopes occur naturally and such names as radius and uranium are familar to everyone. The materials we are interested in are artificially-prepared radio isotopes produced in nuclear reactors of the type which will soon be in operation at Lucas Heights. The non radioactive element is converted to a radio isotope by more or less "baking it" in the reactor as a housewife bakes a cake. In the same way as the cake accumulates heat and is cooked, the element accumulates energy and becomes radioactive. When it is removed it "cools down" by giving off some of the surplus energy in the form of alpha, beta and gamma emissions.

Fortunately radio isotopes react in the same way as their normal forms. For instance phosphorus 32, the radioactive form of phosphorus, is used by plants and animals, and reacts chemically the same as normal phosphorus. Since very small amounts of radioactive materials can be detected, radio isotopes can be used to label materials so that their subsequent movement can be traced. It is a little bit like adding dye to water and following its movement, or branding sheep so that everyone knows where they come from.

In agricultural research radio isotopes are either used in small quantities as tracers, or radiation is used in large doses to induce genetic changes in plant material.

In plant nutrition the investigation of many problems can be assisted by radio isotopes. For instance, there is a need today for information about the fate of superphosphate applications to soils. We know that only a relatively small percentage of the phosphate applied reaches the plant. We want to know whether the rest is irreversibly fixed; is merely out of the reach of the roots, on or near the surface; or is washed away. It may be that all these actions take place under certain circumstances, so we then want to know under what conditions or in which type of soil each occurs.

Radio isotopes could also give us some guide to the real residual value of fertiliser applications of zinc and manganese, and why varieties and species differ in their susceptibility to various deficiencies.

In other fields there are many uses for rado isotopes. Research workers interested in irrigation can test the evenness of water distribution under various irrigation

methods quickly and accurately by using water containing a dissolved radio isotope. Research with hormone weedkillers can also be assisted. There is always doubt whether a hormone which fails to kill a plant has actually been absorbed. If the material applied is labelled with radioactive carbon its absorption and subsequent movement can be traced.

Entomologists interested in insect migration also use radio isotopes. A batch of insects are labelled with an isotope and then released. Cobalt 60 may be used as it loses its radioactivity slowly. Any labelled insects captured are known to have originated from the batch released and so their distribution followed.

The plant-breeder subjects seeds to intense radiation and relies on the ability of radiation to increase the rate at which natural mutations or "sports" occur. Some success has been achieved with this technique, and in America a rust-resistant oat variety was produced in only 18 months.

Naturally the use of these materials involves some difficulties. For instance a great deal more care is needed than when using non-radioactive material and it is estimated that five times as long is needed per operation. If used in excess, radio isotopes will damage the plant and affect its development. Also some elements lose their radioactivity too quickly to be very much use.

However, despite the limitations, radio isotopes have provided agricultural research workers with a valuable tool which, although it will not produce spectacular advances over-night, will greatly assist well-planned work.

GUILDFORD GRASS— SIGN OF A RUN-DOWN PASTURE

By R. A. BETTENAY, Adviser, Dairying Division

A WEED which is causing much concern, in the Busselton district in particular, is Guildford grass—known botanically as Romulea rosea. Many farmers apparently believe that this weed, which is still spreading in many cases, is capable of smothering out healthy clover stands, but this is not the case.

Guildford grass is one of those annuals which is able to grow under conditions of low fertility, and then, if through mismanagement or deficiency of one or more elements the pasture is weakened, is capable of spreading rapidly and so taking control. If a healthy vigorous pasture is present, Guildford grass will not spread and does not become a problem.

Prevention therefore is better than cure and can be achieved by good pasture management, including correct fertilising, letting the pasture grow to a good height between grazings, and periodical cropping and reseeding. This procedure should maintain a dense pasture and so prevent invasion by Guildford grass.

If Guildford grass is present and has taken charge of a pasture the first thing to do is to determine why the pasture became weakened enough to permit invasion. In the Busselton district the answer is usually potash deficiency nowdays, but in some cases it may well be copper or zinc deficiency if these trace elements have not been used, or may be due to over-grazing. It is useless to attempt control of the Guildford grass without at the same time correcting deficiencies, as an important aspect of control is the competition provided by a healthy pasture. In some cases if deterioration has not proceeded too far and sub-clover is still present, the application of potash at 1 to 2 cwt. per acre is sufficient to encourage the better species and so smother the Guildford grass.

If, as is frequently the case, sub-clover is almost non-existent, ploughing and resowing will be needed. Ideally, for the control of Guildford grass, ploughing should be done in June after the old bulb

is spent and before the new bulbs have formed. Mouldboard ploughing is the best and the depth should be such that the bulbs are turned up to the surface.

This working can be followed either by spring-sown oats planted in August or early September or by a summer-growing crop such as Sudan grass planted in early October or as soon after as the land is dry enough to work.

If the land is winter wet, it may be necessary to leave the ploughing until perhaps September, and in this case it is probably wise to plant Sudan grass. Ploughing at this time is not such an effective control but if assisted by cropping and reseeding, can give satisfactory results. Summer cultivation is not effective as a means of control of Guildford grass.

A Sudan grass crop planted in October-November would be grazed out in March-April of the following year and it is important to then resow the pasture to some vigorous mixture of clovers and grasses, the species used depending on circumstances, and to graze very sparingly the first year so that the pasture can actively compete against those Guildford grass plants not controlled by the working and cropping.

Adequate fertilising to correct any deficiencies must be carried out at the same time and if you are in any doubt as to the fertliiser mixture to use, your local Agricultural adviser will be glad to visit your property and give on-the-spot advice.

SILAGE AND WHEN TO FEED IT

By R. BETTENAY, Adviser, Dairying Division

UNDER the stimulus of the competition being conducted by the Australian Dairy Produce Board Pasture Improvement Committee, in co-operation with the Department of Agriculture, and aided by the increase in mechanisation, the quantity of silage being made on dairy farms in the South-West is being considerably increased. This being so, a question often asked of the agricultural adviser relates to the best time to feed silage to the dairy herd to make the most efficient use of the limited quantity available.

The answer to this question is largely determined by the time the cows calved; if you have late calvers it may pay to feed silage from early December onwards so as to maintain production into the summer months. For this to be successful an early start to feeding is imperative as the protein content of pastures drops rapidly with maturity and this limits production even though paddock feed is still plentiful and of apparently fair quality.

More commonly, with April-May calvers it is better to commence silage feeding about a month prior to calving and to continue until pastures are well away and high enough for rotational grazing to be commenced. By this means—provided of course that the quality of the silage is satisfactory—cows can be calved down in rising condition, and can be kept milking until paddock feed comes away. This works in well with the recommended technique of shutting up most of the farm with the opening rains and not grazing until pasture is about four inches high.

Just how early in the autumn you start to feed silage will depend on the quantity you have. If you have no other source of high protein feed available at that time—that is no summer fodders, irrigation or good summer pasture—cows will require about 60 lb. of good quality silage and this will supply perhaps two-thirds of their food requirements. You should start by feeding smaller quantities and work up to this amount over a few weeks.

This system of feeding cows will require about 60 lb. of silage per head per day for three and a half months—perhaps March, April, May and part of June—and this is equivalent to three tons per cow.

If you are wondering how much your stack or pit contains, calculate on the basis of 50 cubic feet of settled silage per ton.

At the break of the season, the feeding of hay also should start, and most paddocks should be closed. Then when paddock feed is high enough to graze, silage feeding can be discontinued, or the amount fed can be reduced, but the feeding of hay should continue right through the winter and at a reduced rate until well into September.

As a farm policy I believe that silage making should be combined with early calving. If you have silage it is quite safe to calve cows in early April—or even commence about March 20. Then, if the season is late in breaking, silage—provided it is of good quality—will be sufficient to maintain production in the early stages of lactation when, in any case, the hormonal urge to produce milk is at its strongest.

No farmer in the butterfat zone likes milking cows much after Christmas and, as you have found, it is difficult to prevent cows from drying-off at this time regardless of when they calved. Why not resolve this year to commence mating about June 15, and to conserve silage to ensure that early calving is a success. It will pay dividends in longer lactations and higher production.

ANTS IN THE APIARY

By R. S. COLEMAN, Officer in Charge, Agriculture Section

ANTS are possibly the most serious of the pests the beekeeper has to combat, but as bees and ants are fairly closely related to each other, the insecticides that kill the ants, also kill the bees and anything that is obnoxious to the ants is equally obnoxious to the bees.

Many and varied are the methods used by beekeepers to control ants. One of the best is to plough the apiary site before putting the bees down. If you are a constant user of a site and a good friend of the land-owner he may do it for you when putting in his firebreaks. Now that many of the beekeepers have Land Rovers, a light orchard cultivator pulled behind the vehicle can be used for breaking up the ant nests and destroying the ant population on the proposed apiary site. As it is usually only in the summer that the ants are difficult to control this would also give protection against fire.

Another method of stopping the ants which I have found most effective is to spray the ground between the hives with DDT mixture with a watering can. The reason why I use a watering can is that the drops are large and there is no spray blowing into the hive as there would be if a knapsack spray was used and as bees find the smell of DDT obnoxious they avoid the DDT. This means the ants that

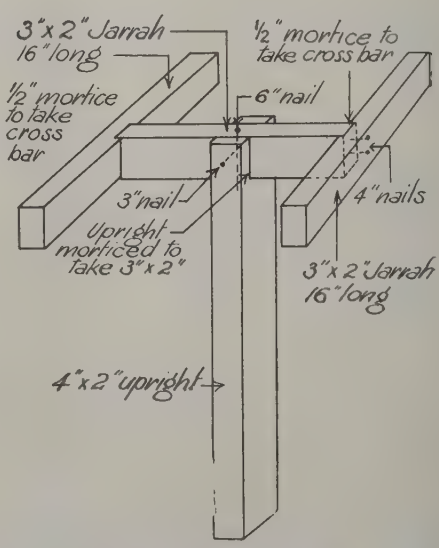


Diagram showing construction of the "Floating H" hive-stand

must walk over the ground to get to the hive are killed by the DDT while the bees are untouched.

The one most common type of ant in the dryer areas is what is usually called the red meat ant which lives in a large mound and ranges for hundreds of yards around the mound for its food. Scattering DDT around the mound will do quite a lot towards control if the nest can be found by following a trail of ants from the hive to the mound.

A beekeeper acquaintance of mine showed me one very good method to control these ants. He had a wire mesh tea-strainer which he filled with powdered sheep dip and with this he dusted all the openings of the mound, coming back a week or fortnight later to check and treat any openings still being used.

I have found both arsenical sheep dips and the DDT sheep dips effective, but the DDT dip is excellent in the watering can method.

If you keep your bees in the one place all the time, the floating H stand is the best. This is a single upright with a platform on top built to take a hive.

Some beekeepers have made these out of iron, others of wood but the secret is to make it strong so that the platform on top cannot move, for I can assure you there is nothing more devastating than a hive wobbling around on top of one of these platforms.

Other beekeepers suspend their hives on wires running through bottles or on stands that have oil around the legs or have the legs of the stand placed in dishes of oil. Sooner or later however, the protecting layer of oil is apt to be bridged by dust or falling leaves and the ants still reach the hives. I have found that the watering of the apiary with DDT in a grid after all the ground cover is removed is the best control method for ants, and it is certainly the cheapest and the most economical. With the amount of walking which takes place around the apiary the DDT grid is soon destroyed and the ants tend to come back after about four weeks but as it is only half an hour's job to renew the grid it is well worth while, as the cost is very small.

BACTERIAL CANKER OF STONE FRUITS

By OLGA M. GOSS, B.Sc. (Hons.), Plant Pathologist

ARE you one of the many stone fruit growers who have been worried by young trees dying limb by limb over a period of two or three years? If so, your trees almost certainly have the "bacterial canker" disease. It is very serious on stone fruits, particularly plums and once established is very difficult to control adequately. Hence do your utmost to avoid introducing or spreading the trouble in your orchard. For those of you who may not be familiar with the disease, firstly let me briefly describe the main symptoms.

Usually the first thing the orchardist notices is that odd limbs of young trees have either failed to shoot or have suddenly died off whilst in full leaf—the dead leaves remaining on the branch. On closer inspection he will discover that split-like cankers have developed in the bark and that gum is exuding from these slits. The limb appears flattened in the region of the slit and when the bark is shaved off with a sharp knife the lower bark and wood beneath, appears brown instead of the normal healthy green. The root stock is unaffected by the disease and frequently a number of water shoots are found growing up around an apparently dead tree.

The organism causing all this trouble is a small germ called *Pseudomonas syringae* and it has two characteristics which are important in relation to control.

Firstly it is most active during the cooler months of autumn, winter and spring and secondly its spread is facilitated by the presence of wounds. For these reasons

infection occurs mainly during leaf fall and pruning, although resulting disease symptoms may not be obvious until later in summer when the trees are stressed for moisture. Control measures therefore aim largely at preventing the spread of the disease during the susceptible leaf fall and pruning periods.

Firstly, during leaf fall, spray regularly, if possible once a week, with streptomycin antibiotic at the dosage rate mentioned on the bottle, or, if this is too expensive, Bordeaux mixture should afford some measure of control if applied frequently.

Secondly, at pruning, be careful to disinfect your secateurs after pruning each tree by immersing in formalin solution made by mixing one part of commercial formalin with 49 parts of water. For preference, use at least two pairs of secateurs, alternating their use. If the secateurs are not thoroughly disinfected, spread to a number of trees can result. Where possible, avoid pruning diseased trees during the winter.

As the disease is inactive during the summer months, now is the time to do any major pruning such as removal of dead branches, etc., from your diseased trees. Again disinfect any implements used, with formalin and paint over large pruning cuts with streptomycin in lanolin or some other fungicidal dressing to prevent further spread.

The disease is most serious on young trees up to ten years old. Older trees can become infected but are usually more resistant and will frequently live on for quite a number of years even with the disease, whereas young trees will be killed in a few years.

In Western Australia so far, plums, particularly the varieties Wickson and Narrabeen have been most seriously affected, but the disease also occurs on apricots, peaches, cherries and flowering peaches.

A leaflet giving more details of the bacterial canker disease of stone fruit is available from the Department of Agriculture, on request.

POISON PLANTS IN THE HOME GARDEN

By R. D. ROYCE, Acting Government Botanist

IT is a strange fact that some of the most spectacular species of our flora are highly toxic, and it is probable that the same applies to most floras. And so it is that collectors who gather seed of showy plants for propagation in other countries, will obtain many which are poisonous. Thus in Western Australian gardens a number of the most popular shrubs are potentially dangerous.

Some families of plants are more toxic than others; thus in the native flora a large number of pea-flowered plants are notorious killers of stock, while among horticultural plants the potato family or *Solanaceae* ranks high in the percentage of toxic species it contains, although it also includes numerous useful plants, notably the tomato and tobacco as well as the potato.

A number of the plants of this family are grown for the attractively-coloured berries which resemble miniature tomatoes. Generally speaking, the green developing fruit of these plants are relatively high in toxic principle, and if eaten in this condition could cause trouble, particularly with children. When fully matured and coloured, however, most of these fruits are harmless and even palatable. Plants of this family which are commonly grown for the berries are Japanese Holly *(solanum giganteum)* Madeira Winter Cherry (*S. pseudocapsicum*) the egg-plant and the garden chilli.

The thick-stemmed so-called "Potato Creepers," *S. Wendlandii* and *S. Seaforthianum* are commonly grown over fences, and although here they do not normally bear fruit their leaves and stems are toxic.

The potato itself is one of the most prized and most widely used plants of this family, and yet the greened or sprouted tubers—i.e., the actual potato of commerce—are highly toxic. Human beings and all classes of stock, particularly pigs, have been affected by them, while the stems and leaves of this, and of the Cape Gooseberry are recorded as being toxic to most animals and have caused losses.

Perhaps the most spectacular of all the garden plants of this group is the trumpet flower, *Datura arborea,* also known as *Brugmansia.* Both this and the thorn-apple, *Datura metel,* contain poisonous alkaloids, but are widely grown throughout the State.

The night-flowering jessamine is a beautiful and heavily-scented creeper and is a prized exhibit in many gardens. But it too is toxic, and in districts of Queensland and New South Wales where it has become naturalised it has caused losses among cattle. The "shoo-fly," which is only occasionally grown, does not possess any fly-repellent properties, but it is toxic, while a species of *Brunfelsia* closely related to the plant common in gardens here, was formerly used as the source of a deadly arrow poison.

These are but a few of the common plants of one family, the *Solanaceae,* which are grown in this State. Other families as those containing the poppies, legumes, spurges, dogbanes and milkweed, each of which contains a fairly high percentage of toxic species, are all represented in our gardens. Yet the danger is more apparent than real as little trouble has been experienced in the past, and there is no real reason why these plants, if treated with reasonable care, should not continue to be used in horticulture.

THE CABBAGE WHITE BUTTERFLY

By C. F. H. JENKINS, Government Entomologist

A FEW days ago I was surprised to see a suburban housewife pursuing a white butterfly around the garden with a fly swat. This form of activity is highly beneficial as a slimming exercise, especially during a heat wave, but it is a complete waste of time viewed from the pest control angle. As a matter of fact, the cabbage white butterfly is probably the most maligned insect in the home garden, for it is blamed for a great many disdemeanours of which it is quite incapable. Choice blooms are said to wither after a visit from this butterfly, and it is also blamed for almost any green caterpillar which appears on the scene.

To the vegetable grower, including of course the commercial market gardener, the cabbage butterfly can be a serious pest, but the range of plants attacked is definitely limited. As the popular name suggests, the favourite food plants are cabbages and cauliflowers, but related vegetables such as turnips, swedes, radishes and kale are also attacked.

In the flower garden the butterflies are very active during the spring and early summer, but although they visit almost anything in bloom, they cause no direct damage whatever. Even the caterpillars have very limited scope as far as ornamentals are concerned. for stocks and nasturtiums are about their only choice of suitable food.

The cabbage butterfly is frequently referred to as the cabbage moth, or the white moth, but such names are most inappropriate, because in the first place the insect is a true butterfly, and in the second place the true cabbage moth was a common pest in this State long before the white butterfly arrived.

The cabbage moth is a small greyish creature not much bigger than a clothes moth and consequently the caterpillars are also very small. They can be very destructive however, and in pre DDT days made it almost impossible to grow first-class

Adult butterfly on a cabbage that has been badly damaged by the caterpillars

cabbages or cauliflowers during the summer months.

The caterpillars of the cabbage white butterfly are velvety green in colour, and may match their food plant so accurately as to be easily overlooked, at least in the early stages. For this reason infestations are often firmly established before a grower becomes aware of them, and when ragged leaves and damaged hearts tell the story, control may be difficult.

The cabbage butterfly is a comparative newcomer to Western Australia, having been first recorded in 1942, but the pest is now widespread over the southern portions of the State. Unfortunately it does not have to depend upon cultivated plants for an adequate food supply, for such prolific weeds as mustard, wild radish and wild turnip maintain a high butterfly population.

The native home of the cabbage white is Europe, but it was accidentally introduced into North America about 1858, and since then it has spread to many parts of the world. Although some of the spread from country to country has undoubtedly been helped by contaminated plant material and ships' stores, the butterfly's remarkable powers of flight have also been an important factor. For instance in Europe there is a more or less regular movement of butterflies from the Continent to England each spring, and it is probable that the infestation of Tasmania was caused by butterflies making their own way across Bass Strait.

DDT dusts and sprays will usually give good control of both cabbage butterfly and cabbage moth caterpillars. Some market gardeners however, prefer an allied chemical known as DDT or TDE.

Several attempts have been made to establish parasites of the white butterfly and two very useful wasps are now active in most areas. One species, which was imported in 1943 attacks the butterfly chrysalis, and another type, introduced about 1950 attacks the caterpillars. Both wasps are very small and lay their eggs into the immature stages of the butterfly. The resulting maggots feed internally and prevent the development of the adult insect. Evidence of parasite activity can sometimes be seen on cabbage and cauliflower leaves in the form of yellow silken cocoons. These little clusters are formed by the wasp maggots after they have left the dead caterpillars.

There are some home gardeners who depend more on black magic than science for protection against cabbage butterflies and I am told that egg shells mounted at each corner of the cabbage patch are sure cure. The official recommendation however, is early and careful spraying.

SUMMER TREATMENTS FOR SAN JOSE SCALE

By C. F. H. JENKINS, Government Entomologist

THE importance of San Jose scale to the Western Australian apple industry has changed greatly during the last couple of seasons because of stricter quarantine laws overseas. In the past, San Jose scale has been just one of the "rank and file" orchard pests, but its new status could easily place it ahead of fruit fly and codling moth as far as the export trade is concerned.

The scale has been known in Western Australia for over 50 years, and although its importance has fluctuated from season to season and infested lines have always been barred from shipment overseas, the pest was not a major hazard to the apple industry. At the present time, however, the finding of a single San Jose scale by inspectors in various European countries could lead to the banning of a complete cargo.

The reason for this stricter enforcement of quarantine regulations is not very easy to understand, as the scale has a wide distribution in Southern Europe, America and Africa. Great Britain and some of the northern European countries are apparently free from scale, and quite rightly wish to remain so. But as they have imported millions of cases of apples in the past without serious consequences their change of policy seems unduly severe.

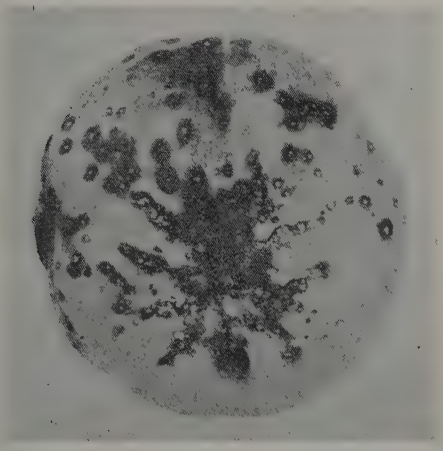


Fig. 1.—San Jose scale on apple, showing the scales themselves and the typical discolouration caused by them

At the present time however, all the Western Australian orchardists can do is to try to ensure that ample clean fruit is available to comply with the most rigorous inspection system. It is still too early to forecast the effect of seasonal conditions on the scale, but many growers are apprehensive in view of the heavy build-up of the pest last summer. As a result of last year's experience, and following a vigorous drive by the Department of Agriculture, most growers have applied their dormant sprays much more thoroughly than usual and should reap the benefit.

Bearing in mind the necessity for absolutely clean fruit however, not just good control as in the past, at least one summer treatment for San Jose is urgently recommended. However carefully the oil or lime sulphur sprays were applied during the winter there is always the danger of a few scales persisting in cracks, on the tips of branches or in other situations not thoroughly drenched with spray. To fully appreciate this aspect of the problem, perhaps a little more detail on the life history of the pest would be helpful. The female insects produce living young during the warmer months of the year, and these tiny crawlers settle down on shoots and fruit to grow to maturity. Once firmly settled the young scales lose all powers of locomotion, and under the shelter of their dark waxy covering spend their days sucking the plant juices. During their feeding activities the scale insects inject saliva into the plant cells and this results in bright red stains appearing on young twigs and green or pale coloured fruit.

Parathion is the most effective of the new insecticides for summer treatment against San Jose, but many orchardists will probably prefer to use something less dangerous. A very useful mixture which

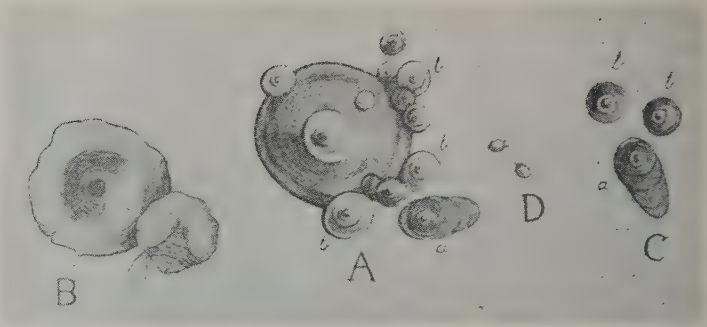


Fig. 2.—Various stages of San Jose scale, all enlarged about 15 times

A—Adult female with immature young at various stages on and around her; B—Adult female scale turned over to reveal the insect itself with the bristle-like mouth-parts exposed; C—Adult male with two immature winter-stage scales; D—Young crawlers soon after birth

will be found helpful not only against scale insects but for leaf hoppers and mites, is a mixture of white spraying oil and malathion. The formula recommended is—

White spraying oil—1 gallon.
50% Malathion—1¼ pints.
Water—100 gallons.

To be effective this spray must actually hit the young scale insects, and so a thorough treatment reaching the inner branches and fruit as well as the leaves is absolutely essential.

Some growers may find it hard to accommodate themselves to the changed conditions and may feel inclined to depend on the dormant sprays and hope for the best. But if the present scale ban is maintained by importing countries, the stakes are far too high to be taken lightly. The prudent grower therefore, will certainly apply one summer spray, and perhaps a second, if there is any indication of scale activity.

PREPARATIONS FOR FODDER CONSERVATION

By H. G. CARISS, Agricultural Adviser

THE supplementary feeding of stock carried in the cereal and sheep areas is an accepted practice, and more and more farmers are realising that if they are to obtain maximum production per acre from their sheep and cattle, the rations available to them at all times of the year, must be adequate, not only in quantity but also quality.

The provision of fodder reserves which are required for the dry and leaner periods of the year should not be on a "catch as catch can" basis, but should receive particular attention as they are of such considerable importance. The availability of adequate supplies can mean a difference, not only in production per head but can obviate any necessity for the forced disposal of good breeding and producing stock.

Conserved fodder is made up of several types, the concentrates being the grains, and the bulk feeds are hay, (either cereal or meadow) and silage.

It is desirable that every stock owner should plan his fodder conservation programme at the beginning of each season, that is now, rather than wait until the spring.

In preparing the programme, the major factors concerned are the types of stock, large and small, breeders, dry and weaners carried and the period over which it can be anticipated feeding will need to be carried out. As a broad guide, it is suggested that the minimum amounts conserved for sheep be sufficient for at least three months hand feeding on the basis of ½ lb. of grain and 1 lb. of hay per head

per day; for cattle, 5 lb. of grain and 10 lb. of good quality hay per head per day, for approximately the same period.

In addition, it is desirable to have on hand at the end of the season at least half as much as the above annual needs.

In most districts, it is a good plan to sow some acreages specifically to provide for these requirements. In the more favoured districts of course, the major proportion, if not the whole of the hay supplies can often be procured by the cutting of good meadow hay, which latter is a particularly good form of bulk feed for both sheep and cattle.

At the beginning of the season many farmers like to have available cereal crops for use as green fodder and if these are carefully managed, they can also provide excellent reserves of fodder for the summer, either harvested or as standing crops. The cereal crops also are the source of the grain supplies.

If a good season is experienced, it is possible that a proportion of those crops originally intended for fodder can be disposed of and so add to the farmers income. If the season is poor, then he has insured against a difficult period for his stock.

Another factor of importance to be considered is that quantity is not everything and it is very desirable that all fodder conserved, and particularly the hay portion, be of the best quality. It is quite well known that the association of a legume with a grass makes the best meadow hay. The same applies with cereal hay, that the addition of a legume such as peas or vetches, improves the quality and particularly the protein content, which is of such great importance to the animal. The conserving of good quality material will mean less handling, less waste and better animals.

Over the last two years, a fodder conservation competition has been conducted in the cereal and sheep areas and the results have shown that it is possible for farmers in both light and heavy rainfall districts to make provision for adequate supplies of good quality conserved fodder and by good management carry greater stock numbers, keep their stock in better health and ensure high production per acre.

SUDAN GRASS SURVIVED DRY SUMMER

By R. A. BETTENAY, Agricultural Adviser.

THE dairying districts of W.A. have just come through one of the driest summers ever experienced and the dry period was further accentuated by a very dry spring. Yet despite the dryness it is interesting to see that some crops of Sudan grass, even on hillside country, have given good growth and carried a lot of stock. Other crops failed to germinate when planted in the spring and either did not come up at all or had a partial germination with small falls of rain experienced during February and March in some districts. The difference between successful crops and other complete failures is most striking and it is worthwhile investigating to see how the successful crops were grown.

Water, of course, is the first essential for a successful crop. In some years good falls of rain are experienced during the spring-summer period but such falls are not reliable and cannot be counted upon to get the Sudan grass established. Farmers then, who have no irrigation, have to rely on winter rains and have to work the soil in such a way as to conserve winter rainfall for a spring-sown crop. To do this early fallow is essential, as during October and November a rapidly growing pasture can transpire the equivalent of one inch of rain per week. Our sandy soils in the top two feet can only hold in the order of two to three inches of available water and hence the necessity to kill pasture growth in the early spring to conserve moisture for the Sudan grass crop.

Many farmers are unwilling to plough up land in the early spring, feeling that

they cannot spare the paddock, or at least that the feed it would grow during October would be very useful to have. However, as explained, leaving the paddock under pasture during this time robs the soil of the moisture so essential for the establishment of the summer crop and it would be better to either cut for silage in early October or graze the paddock heavily and then cultivate. Sudan grass is rather deeper-rooted than our normal pasture species and can, in most soils, make use of the water stored in the top four feet. In dry land conditions it should be planted not later than early December and provided there is sufficient moisture in the surface soil for germination and early establishment, Sudan grass can survive quite extensive droughts because of its deep-rooting ability.

Finally for successful establishment do not be afraid to sow the Sudan grass deeply to get down to the moist soil. I have seen very successful crops of Sudan grass in paddocks where the seed was sown to a depth of approximately six inches by ploughing it in. The seed will not germinate without moisture and, if fallow was prepared too late to keep the surface soil moist, you either have to rely on summer rains to germinate the seed, or get the seed down to the moisture. In our climate where summer rains are very unreliable the latter is a far more satisfactory alternative.

In dry-land conditions, Sudan grass should be sown at the rate of 10 to 12 lb. of seed per acre if broadcast, and 8 to 10 lb. if drilled in. A mixed fertiliser containing adequate sulphate of ammonia should be used but it is difficult to make a definite fertiliser recommendation without taking onto consideration the soil type and previous fertiliser treatment.

Finally our experience has shown that the so-called sweet Sudan grass cannot be recommended, as it is less vigorous than the ordinary commercial Sudan grass, and does not recover as well after grazing.

ROOT MAGGOT FLIES

By J. A. BUTTON, Entomologist

COMMON names for insects are seldom chosen, but "come about," as it were. Hence we find ourselves compelled to use (whether we like it or not) such terms as "Two-tooth longicorn" or "Tropical itch mite," or occasionally something as unattractive sounding as "Bean root maggot fly."

But, attractive or not these names are usually remarkably apt—as is the case with Root maggot flies.

These belong to a family of flies which includes many pests of economic importance—some attack cabbages, some beans, and peas, and some onions. Many gardeners and probably most commercial onion-growers will be all too familiar with them. But there are, doubtless, some backyard growers who have been puzzled to see their hoped-for bean crop fail to emerge, or else struggle through only to wilt and rot before they have grown six inches. They haven't noticed the small maggot which has burrowed its way into the soft damp tissue of each plant.

It is always the maggot which causes the damage and the parent fly was probably thought to be an ordinary house-fly. In fact, there is a strong general resemblance although the maggot fly is somewhat longer and covered in fine hairs.

The most important species locally are the Bean root maggot fly and the Onion fly. Consequently, beans and onions are most frequently damaged—although cabbages are sometimes attacked.

The eggs of the Bean root maggot fly are normally laid in cracks in moist soil close to the host plant. It usually takes three or four days for the eggs to hatch and the maggots to enter the germinating seed. Breakdown in the tissue rapidly follows and is aided by bacterial action. The maggot stage may last from two to several weeks before pupation occurs. If the weather is suitable adults may emerge

from the pupal cases in a fortnight and give rise to further generations, or in less favourable conditions, this stage may be extended to several months.

When the attack is a severe one, plants may be reduced to a pulpy mass, but in lighter infestations, plants though pale and unthrifty, may survive.

In view of what has been said it will be obvious that the plants should be given every opportunity to get through quickly. Hence seeds should be planted as shallow as possible and the soil should be worked to prevent cracks forming. Organic manure is particularly attractive to the flies and surface applications of fertilisers such as blood and bone and stable manure should be avoided as far as possible.

Overseas experience indicates that the most satisfactory control with chemicals involves seed treatment with insecticides. A process of wet pelleting with insecticides, a fungicide and a sticking agent has been most successful, and has been used to protect both bean and onion crops.

However, the inconvenience of these methods and the spasmodic nature of the trouble locally, led us last year to test a number of insecticides applied directly to the trenches after planting—the crop concerned was beans. Without entering into detail, it will be sufficient to mention here, the insecticides which gave the most promising results. They were applied with a knapsack in the normal way at a slow walking pace.

Chlordane—at the rate of 10 oz. of actual insecticide per acre.

Dieldrin—at the rate of 3 oz. per acre and Diazinon also at 3 oz.

For the backyard gardener a 2 per cent. chlordane or a ½ per cent. dieldrin solution will be quite satisfactory.

Similar treatments should also be useful against the onion fly, but in this case post-emergence surface treatments may be necessary at a later stage. A knapsack may be used and a six-inch strip of soil about the base of the plants sprayed.

This treatment should be equally useful against maggot flies in cabbages and cauliflowers.

It is hoped that further work along these lines will be possible next season and this should enable us to make more specific recommendations for local conditions.

FALLOWING FOR CROPPING

By A. S. WILD, Assistant Superintendent of Wheat Farming

THE introduction of fallow as a general practice from 1912 onwards, marked a substantial step forward in the progress of agriculture in the Western Australian wheatbelt. Within more recent years, it has been paralleled by the introduction of early strains of subterranean clover and the development of the ley farming system, mainly in lighter types of soil in districts with an annual rainfall of more than 14 in. In such areas, fallowing may be said to be supplanted by this more profitable system which however, must be adapted to ensure the adequate control of certain diseases and pests affecting cereal crops.

Well-fallowed land is still necessary for good crops on heavy land in the lighter rainfall areas. There are a number of reasons for fallowing and the degree of importance of these may vary from farm to farm and even from year to year.

The late winter and early spring fallowing of land and preparation for planting during the following year is in itself a convenient way of distributing the seasonal work on the farm. The relatively slow ploughing operation is undertaken at a less pressing time of the year, leaving the limited seeding period free for cultivation work of final preparation and actual sowing. Such an advantage was however, more evident in the days of horse teams rather than the present time of mechanised traction, but it is still important, especially when delay of the opening rains shortens the planting season.

Weed growth can be controlled by the ploughing and cultural operations undertaken at opportune times over the extensive period between ploughing and planting. A thorough early ploughing turns in the weeds before they become deep-rooted and preferably after they have been grazed back by sheep.

A subsequent spring cultivation is usually required to control further weed growth and either break up larger clods or, if carried out to a shallow depth and in the wet condition, to prepare a consolidation of the seed bed on the more friable soil types. Cultivation during the summer period with its general dry conditions in this State, is not necessary or profitable. Early rains prior to or during the early part of the normal planting season, when the soil conditions are still warm, promote a quick germination and rapid early growth of weeds. A working must be carried out to destroy these and prepare a good tilth into which to plant.

The control of weeds from ploughing to planting—is closely associated with the control of serious fungal diseases, especially those allied to take-all, and also to the control of insect pests including webworm.

The provision of a fallow, bare of host plants, including barley-grass and speargrass, and the planting on to a clean seed bed on which surviving fungal spores have germinated and died through lack of grass plants to parasitise, considerably reduces the chance of a serious infection of take-all.

The most important advantage of fallow in the lower rainfall districts in from the greater conservation of moisture for the subsequent crops. The old concept of mulching reducing evaporation is not strictly correct. Fallowed land however, permits better penetration of spring rains much of which would be lost on hard-surfaced, unploughed land. Also, ploughing largely eliminates weeds which, otherwise, would use moisture during late spring.

The availability of plant nutrients within the soil as distinct from those applied through the drill is a major effect of fallow. Nitrogen is undoubtedly the most important element involved.

Beneficial soil organisms multiplying and operating under favourable conditions, break down organic matter to available nitrogen which nourishes the growing crop. Conditions favourable to this process are moisture, warmth and air, and the longer period under which this can operate within a 12-month period, the more nitrogen will be available from the existing organic material within the soils for use by subsequent crops. Early fallow —from land ploughed in June and July as against August and September, can result in better weed control, more effective control of disease and increased plant food to produce high yielding crops.

However, it should not be overlooked that fallowing adds nothing to the soil. It increases the amount of available nitrate nitrogen through the action of soil bacteria on the organic matter in the soil. The soluble nitrate nitgrogen is quickly lost both by growing the crop and by leaching. Too frequent fallowing and cropping will soon result in soil nitrogen depletion. This can be avoided by a suitable rotation with periods of pasture.

FEEDING FOR MILK QUALITY

By L. C. SNOOK, Animal Nutrition Officer

MILK which is sold for human consumption must be clean and of good quality. To safeguard the public, the Milk Board lays down definite standards which must be satisfied in all milk which is placed on the market. Such milk must be reasonably free from living organisms, it must contain 3.2% of butterfat and 8.5% of solids-not-fat. It is the latter fraction, the solids-not-fat, which contains the most valuable constituents to the consumer and is the source of most trouble to the producer.

In the "bad old days," regulations were needed because milk was sometimes produced under unhygienic conditions, and the milk could be adulterated with water. Today, however, the dairy industry is faced with quite a different problem, a problem which persists despite endeavours by the dairymen to prevent it. At certain periods of the year a considerable volume of the milk which is forwarded to the receiving depots is deficient in solids-not-fat. There is no question of adulteration or carelessness but simply a change in the quality of the milk produced by the cow.

This has meant that quite a few honest dairy farmers have faced the threat of prosecution for selling what appeared to be good milk. Not unnaturally this has produced a widespread feeling of disquiet throughout the industry.

WORLD-WIDE PROBLEM

The problem has appeared all over the world. In fact, it has become so general that the argument has been advanced that the standards set for milk quality are too high. It would be a negative step, however, to lower standards. In fact, it should be the object of producers to improve quality and so encourage increased consumption. Quite correctly, the authorities have refused to lower the standards. Milk of good quality can be produced and it is the responsibility of the industry to see that only good quality milk is sold.

This is all very well but the matter cannot be left on this idealistic plane. We must be certain that the dairy farmer can produce the high quality milk which we demand. It is important, therefore, to consider the factors which determine the quality of the milk yielded by the dairy cow.

BREED INFLUENCES

When I was a student I was taught that the quality of the milk was determined almost entirely by the breeding of the cow. We were told that the volume of milk could be influenced to a large degree by feeding and management, but that the "richness" was determined irrevocably at birth. With certain reservations this teaching was correct. Dairymen must face up to the fact that the breed of the cow is the most important factor which determines the quality of the milk. Unfortunately, milk is purchased according to its volume. This means that the most profitable cows are those which produce a large volume of milk which will just pass the standard.

Under the present system this state of affairs must be accepted. I wish to make it clear, however, that the problem of milk quality exists simply because it is profitable to maintain herds which produce a lot of milk containing the maximum permissible amount of water. In fairness it should also be emphasised that many producers now realise this fact. There has been a strong swing to the use of bulls which will improve milk quality. It will take many years, however, to effect an appreciable change in the make-up of our dairy herds. Meantime, can anything be done to help the dairyman with a milk quality problem?

FEEDING FOR MILK QUALITY

Yes, much can be done by correct feeding practices. During recent years much has been learnt concerning the influence of food on milk quality. By using this knowledge the owners of herds producing milk of borderline quality should be able to eliminate the worries which now beset them.

In general, lack of butterfat in milk is not a problem. At times, however, sudden falls in the batterfat content have bewildered dairy farmers. These falls, in the main are due to lack of roughage, and are most commonly seen when herds are placed on lush green pastures in the early winter months. Under such conditions the butterfat content can fall to less than 2%. The effect can be so marked that butterfat producers who have placed their herds on early oat crops have wondered what has gone wrong with their separators—very little cream was obtained from large volumes of milk. Fortunately this decline in butterfat on lush crops can be corrected by the provision of roughage. Hay is the ideal supplement and this should be fed generously during the autumn and winter. If hay is scarce, use can be made of whatever roughage is available. It may be pertinent to mention that the roughage should not be put through a hammer mill. It has been found that if the roughage is reduced to a powder, it is no longer effective in lifting butterfat percentages. It seems that coarse roughage as such is necessary.

Equally definite advice can be given concerning the nutritional factors which influence the solids-not-fat content of milk. These factors have received intensive study abroad, particularly at the National Institute for Dairy Research in Britain. These studies have shown very clearly that the main cause of a seasonal decline in the percentage of solids-not-fat is a lack of easily-digested carbohydrate in the diet. This finding fits in very well with observations made under local condi-

tions. It is significant that the solids-not-fat problem occurs during those portions of the year when feed is scarce. For example, farmers on irrigated properties tend to run into bother during the early winter months when the growth of pasture on low-lying land is at a minimum. In contrast, farmers without irrigation tend to run into trouble during the late summer when the dry grazing has become depleted. I have noticed that a solids-not-fat problem rarely occurs in a herd of fat cows. In fact, in most problem herds the top cows are lean.

It follows that the dairy farmer must feed generously during those periods when his milking cows will otherwise be somewhat short of good quality food. Crushed cereal grains are the ideal supplement and proprietary dairy meals should be equally effective. The farmer can select whichever is the cheapest, or most convenient, and feed this **at a generous level** to the top-producers, whenever there is any likelihood that the grazing may be deficient in quality or quantity.

USE ROUGHAGE CAREFULLY

Care must be taken in the use of roughage, particularly hay of poor quality. Such roughage will not satisfy the energy requirements of a high producing cow and if little else is available, the quality of the milk will be affected. It is important to realise that roughage has a contrasting effect on the amount of butterfat and the solids-not-fat, secreted in the milk. As has already been mentioned, a reasonable allowance of hay must be given to cows on lush green feed in order to prevent a drop in the percentage of butterfat. But if hay, particularly poor quality hay, becomes the main item of diet, then the percentage of solids-not-fat can fall. Here again dairy farmers will find that this statement fits in with their own experience. It is recognised that the solids-not-fat percentages fall during the periods of the year when hay becomes the main feeding stuff. Likewise, the problem disappears when the pastures are good, the cows are fat, and there is no suggestion of any shortage of easily digested food.

It seems, therefore, that the problem of milk quality can be summarised as follows:—

Most of the cows in quite a few dairy herds produce milk which contains little more than the minimum requirements of butterfat and solids-not-fat.

Because there is only a small safety margin, any upset in feeding habits can result in sub-standard milk and the risk of prosecution.

Seasonal declines in butterfat content are most likely to be due to an excessive intake of lush greenfeed. The decline can be arrested or prevented by the feeding of hay.

The main cause of a fall in the solids-not-fat fraction in milk is the shortage of readily available, easily digested carbohydrate. This is most easily supplied in the form of crushed cereal grains, or proprietary dairy meals of high energy value. Excessive use of inferior hay, or unpalatable roughage, will accentuate the fall in solids-not-fat which results from a shortage of good-quality food.

In other words, with better breeding and better feeding, the dairy farmer himself can completely overcome all the uncertainties associated with the production of sub-standard milk.

THE RABBIT – FRIEND OR FOE?

By A. R. TOMLINSON, Chief Vermin Control Officer

THE title might be thought to imply that I am uncertain of the correct classification of the rabbit. However, there is no doubt whatsoever in my mind. Rabbits are the deadly foe of every farmer, of our State, and of Australia. They should be treated as such.

Unfortunately there does not appear to be this certainty in the minds of some farmers, local authorities and others concerned. Ever since rabbits first appeared there has been a certain degree of tolerance for them. In some cases this has

been clearly evident such as with those farmers who have farmed rabbits for the trappers. In most instances however it probably has been quite an unconscious reaction. This would include those farmers who have conscientiously carried the control measures required of them legally, but have not worried much if there were a few rabbits left or even if there were more than a few.

There are of course those who have refused to compromise and have kept up a continuous and remorseless campaign to destroy rabbits. These farmers are unfortunately only too few and even now there are plenty who openly admit they like to have some rabbits around to feed their dogs, to have for an occasional meal and to provide sport by way of shooting for themselves or their friends.

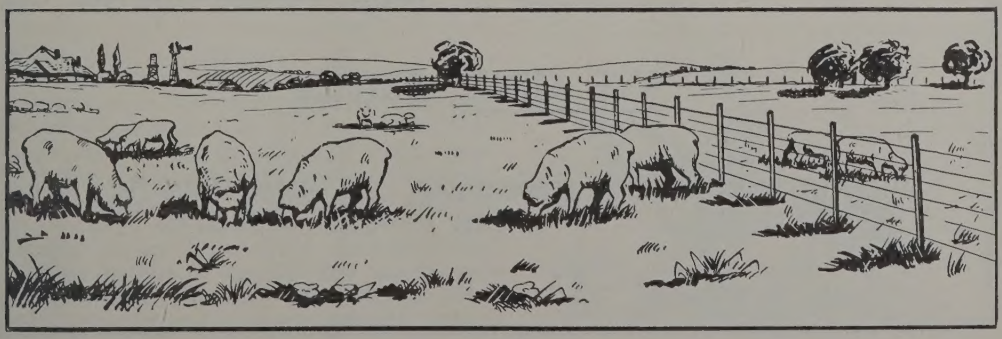
The time has come for us to decide completely and finally one way or the other. Is the rabbit a vicious menace to be treated as an undesirable and unwelcome pest which must be destroyed on sight, or is it to be regarded as a half harmful and half harmless animal?

That is what the New Zealanders faced when they came to grips with the rabbit menace. Their answer was to de-commercialise rabbits as a primary move. As a result the sale or purchase of rabbits in any way is banned and consideration is being given to preventing any type of rabbit being kept.

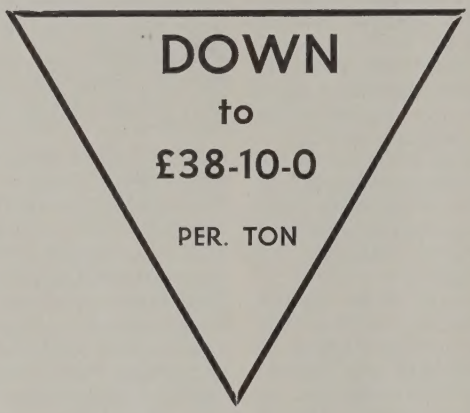
Some Vermin Boards and farmers here have already realised the implication of these steps, and have asked for similar action to be taken here. I read also recently that the secretary of the Graziers' Association of Victoria who has just visited New Zealand has recommended the de-commercialisation of rabbits throughout Australia.

There can be little doubt that no campaign to control rabbits effectively can be successful if rabbits are regarded as being of any value. The fact that the damage rabbits do in eating pastures or crops is not so spectacular as a wild dog killing a sheep should not blind anyone to the fact that rabbits are just as dangerous a menace. Seven of them will eat as much as a sheep, so just as surely they deprive the farmers of their sheep numbers or of their full wool and meat production. They also destroy crops, cause soil erosion and their cost to the community is enormous. The C.S.I.R.O. estimated that each rabbit cost the farmer who maintained it 10s. a year in reduced stock production alone. This does not include the hundreds of thousands of pounds of other losses or expenditure on the routine control work to prevent their overwhelming the country. Two rabbits may cost £1 but in one area of our State last season it was reported that five successive breedings had occurred. With five kittens in each litter, each of the original pairs became 27, with a cost of £13 10s.

I do not think that it requires much consideration to decide which way the answer should be. Rabbits are a menace to our primary production and economy so they are a foe of everyone from the farmer to the city dweller. They should not be regarded as being of any value whatsoever or be tolerated under any circumstances. No effort should be spared to destroy them by every means available with the aim of getting as near to extermination as possible.



APEX B. & B. PRICES



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BOOK Review

NEW WEST AUSTRALIAN YEAR BOOK

A PUBLICATION which deserves to be a West Australian "best-seller" is now available from the Government Printer, Perth, at the amazingly low price of 10s., or 11s. 1d. posted. It is the new "Official Year Book of Western Australia"—publication of which has now been resumed after a lapse of 52 years.

It is a large book—six inches by ten—with nearly 400 pages, fully cloth-bound in an attractive shade of green, and contains 11 full-page plates—three of them in colour. A map of the State, also in colour and measuring 32 by 22½ inches, folds into the back of the book and there are a number of smaller maps, graphs and diagrams in the text.

Its scope is tremendous. Commencing with an historical review of the discovery and development of Western Australia it deals with the geography, climate and geology of the State, the plants and trees which grow here, the animal life and the activities and social patterns of the people.

Population trends, primary and secondary production, land settlement and tenure, constitution and government, public and private finance, employment, wages and prices, trade, transport and communications are among the various subjects dealt with—many in statistical summaries covering progress since the foundation of the Swan River Colony.

As a source of authentic information on almost every feature of West Australian life, this book will be invaluable to students, farmers, business men—in fact to all West Australians.

If one wishes to know the number of post offices in West Australia; the quantity of wheat produced in any one year; the State basic wage in any year from 1926 onward; the number of whales processed or the tonnage of pearl-shell produced; the acreage of the State Forests or the number of motor vehicles licensed; the number of births, deaths, and marriages, or the date of William Dampier's first visit to Western Australia—the answers to all these and thousands of other queries are readily available in the Year Book, with a comprehensive index to facilitate rapid and easy reference.

The work of preparing the first issue of a book of this nature must necessarily extend over a period of years so that some material has been in type for a long time before the last pages can be written and printed. By its very nature, a Year Book cannot present the latest statistics but in most cases the figures given include the 12 months ending June 30 or December 31, 1956. Later particulars are given in publications appearing at shorter intervals and these are listed in the Year Book.

The new Year Book is a publication of which the Government Statistician and all those concerned with its production have every reason to be proud.

("Official Year Book of Western Australia, 1957," No. 1 (New Series) by R. J. Little, Government Statistician. Price 10s. per copy or 11s. 1d. posted in Australia, 12s. 6d. to the United Kingdom and 13s. 10d. to foreign countries. Available from the Government Printing Office, Wembley, W.A.).

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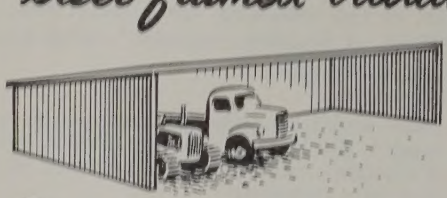

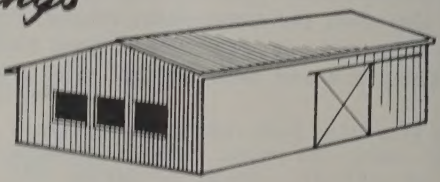

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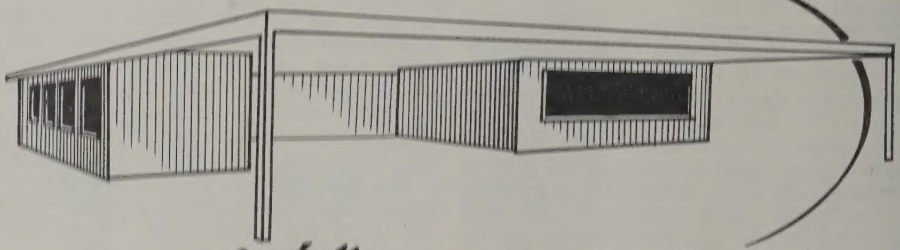

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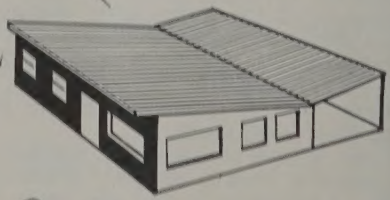

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